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AIRLINER CABIN SAFETY AND HEALTH STANDARDS

HEARING

BEFORE THE

SUBCOMMITTEE ON AVIATION

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

NINETY-SEVENTH CONGRESS

SECOND SESSION

ON

S. 1770

TO DIRECT THE SECRETARY OF THE DEPARTMENT OF TRANSPORTATION TO CONDUCT AN INDEPENDENT STUDY TO DETERMINE THE ADEQUACY OF CERTAIN INDUSTRY PRACTICES AND FEDERAL AVIATION ADMINISTRATION RULES AND REGULATIONS, AND FOR OTHER PURPOSES

MAY 20, 1982

Serial No. 97-122

Printed for the use of the
Committee on Commerce, Science, and Transportation

U.S. GOVERNMENT PRINTING OFFICE
98-930 O WASHINGTON: 1982

S261-64

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AIRLINER CABIN SAFETY AND HEALTH STANDARDS

THURSDAY, MAY 20, 1982

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 235, Russell Senate Office Building, Hon. Nancy L. Kassebaum (chairman of the subcommittee) presiding.

Staff assigned to this hearing: David M. Kirstein, professional staff member, and Charles M. Barclay, minority staff counsel.

OPENING STATEMENT BY SENATOR KASSEBAUM

Senator KASSEBAUM. The hearing will come to order.

We have convened this hearing to explore two issues relating to the health and safety of the crew and passengers on commercial aircraft. For several years we have heard about health problems stemming from prolonged exposure to ozone on very high altitude flights. In addition, the need of the air carriers to conserve fuel have led many of them to reduce the flow of fresh air through the cabin area.

On October 23, 1981, Senator Inouye introduced S. 1770. This bill would direct the Secretary of Transportation to conduct an independent study to review the adequacy of the industry practices and FAA rules and regulations which set the minimum standard for air quality on commercial aircraft. Based on the oral testimony presented today and submissions for the record, the subcommittee will consider whether to recommend further action on this bill.

The other question we will consider today is whether air carriers should be required to carry more sophisticated medical kits. This has been a concern of Senator Goldwater who I think has raised some very challenging questions. We are interested in finding out the extent to which there are medical emergencies during flights and whether or not additional medical equipment would provide any significant improvement in the treatment of on-board medical problems.

The subcommittee is very interested in the health and safety of air travelers and flight personnel. I greatly appreciate the interest that my colleagues, Senator Goldwater and Senator Inouye have shown in these two issues, and I feel that the hearing today will contribute to our understanding of the industry and the needs of the traveling public.

Thank you.
[The bill follows:]

97TH CONGRESS
1ST SESSION

S. 1770

To direct the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and Federal Aviation Administration rules and regulations, and for other purposes.

IN THE SENATE OF THE UNITED STATES

OCTOBER 23 (legislative day, OCTOBER 14), 1981

Mr. INOUYE introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

---

A BILL

To direct the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and Federal Aviation Administration rules and regulations, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) the Secretary of the Department of Transportation shall, in the interest of health and safety, and in the interest of promoting and maintaining a superior United States aviation industry, direct the Administrator of the Federal Aviation Administration to conduct an independent study to de-

termine whether industry practices and standards, Federal Aviation Administration rules, regulations, and minimum standards are nondiscriminatory and at least in conformance and parity with nonaviation standards, practices, and regulations (including de facto circumstances) concerning the following, for all passengers and crew aboard civil aircraft. Special and objective considerations to be given to both positive and negative aspects of the uniqueness of the aviation environment:

(1) quantity of fresh air per occupant and overall quality of air on board;

(2) quantity and quality of humidification;

(3) air contamination limits;

(4) emergency breathing equipment, including toxic fume-protective breathing equipment;

(5) measures, procedures, and capabilities for extinguishing fires and the removal of smoke and toxic fumes within safe pressurization limits;

(6)(a) safe pressurization, considering the broad range of cardiopulmonary health of the traveling public; dissemination of information to the medical profession and the general public of current pressurization limits and practices to assure valid medical advice concerning the health effects of air travel; and

(b) collection and dissemination by the aviation industry, the Federal Aviation Administration, and/or any other private or governmental organization of a data base of medical statistics relating to air travel, in an effort to assess the adequacy of aircraft systems, design, regulations, standards and practices from a health and safety standpoint, and for the purpose of issuing Federal Aviation Administration administrative advisory circulars and airworthiness directive to correct any deficiencies disclosed.

(b) The Administrator of the Federal Aviation Administration shall complete the study required by subsection (a) and submit a report of the results thereof to Congress not later than six months after the date of enactment of this Act.

(c) In conducting the study required by subsection (a)(1) thru (6)(b) the Administrator shall utilize all available studies, recommendations, data, current technology, and state of the art which are relevant to such study.

(d) There are authorized to be appropriated $500,000 for the fiscal year commencing October 1, 1981, to carry out the study authorized by this Act.

Senator KASSEBAUM. Senator Goldwater.
Senator GOLDWATER. I have no opening statement, thank you.
Senator KASSEBAUM. Senator Inouye.

OPENING STATEMENT BY SENATOR INOUYE

Senator INOUYE. Madam Chairperson, I have a statement.
Senator KASSEBAUM. Certainly.
Senator INOUYE. I wish to thank you, Madam Chairwoman, for calling this hearing to consider S. 1770, incidentally, cosponsored by my dear colleague from Arizona, Mr. Goldwater.

As some of you are aware, I travel about 22 times a year to my State. In the last 10 years I have maintained a log, and it appears that I have averaged approximately 23 days per year up in the air. That is a bit more than some of our astronauts. So there are times when I leave the plane a bit groggy, and it is not from alcohol because I do not imbibe in that, and I have been told by those on the aircraft, by stewardesses and attendants that very likely it is because of the quality of the air. As a result, I have become a bit interested in that, and I have done some checking, and the result is S. 1770.

This measure will direct the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and FAA rules and regulations with respect to, first, the quantity of fresh air per occupant and the overall quality of air on board aircraft; second, the quantity and quality of humidification; third, air contamination limits; fourth, emergency breathing equipment, including toxic fume protective breathing equipment; fifth, measures, procedures, and capabilities for extinguishing fires and the removal of smoke and toxic fumes within same pressurization limits; sixth, safe pressurization and the means for collecting and disseminating a data base of medical statistics relating to air travel in an effort to assess the adequacy of aircraft systems design, regulations, standards, and practices from a health and safety standpoint and for the purpose of issuing appropriate FAA administrative advisory circulars and airworthiness directives to correct any deficiencies disclosed.

The cases stating the duty and measure of care from an air common carrier passengers—and there have been many in the courts—declare that such carriers are under duty to exercise either high or the highest degree of care for the safety of its passengers. The carrier must use such care not only with respect to the operation of the plane but also with respect to his equipment, maintenance, and the adjustment of all of its parts. Such common carrier obligations, I believe, have also been implied in the laws.

It is my firm belief that both passengers and crew, as captive travelers and employees, have a right to the highest degree of safety in the environment in which they travel and work.

Madam Chairperson, I am deeply concerned with reports suggesting that the FAA has apparently neglected this area of aviation health safety, and I have been told that this hearing is not the first to be held in addressing such specific issues as ozone.

Like you, Madam, I am well aware of the airline industry's current economic woes, especially with respect to the current cost of

fuel. I am disturbed, but I am disturbed by reports of industry practices that subject unsuspecting passengers to traveling conditions that could very well jeopardize their health in the interest of saving fuel costs.

In addition, I am disturbed by the continued reports of unhealthy working conditions by flight attendants that have gone uncorrected for years. I am also aware that some 20 years ago cockpit crews were provided their own fresh air system as a result of reports of similar working condition complaints. I find it particularly disturbing how an industry which recognized and accommodated problems reported by one segment of its employees can remain totally ambivalent to identical complaints from other segments of the same industry.

Again, I wish to thank the distinguished Senator from Kansas for her leadership, interest, and concern in the issues currently before this Subcommittee, and for her decision to hold hearings on S. 1770, a bill I introduced in October 1981, cosponsored by my good friend from Arizona, Senator Goldwater, directing the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and FAA rules and regulations with respect to, among other things, the:

(1) quantity of fresh air per occupant and the overall quality of air on board aircraft;

(2) quantity and quality of humidification;

(3) air contamination limits;

(4) emergency breathing equipment, including toxic fume protective breathing equipment;

(5) measures, procedures, and capabilities for extinguishing fires and the removal of smoke and toxic fumes within safe pressurization limits;

(6)(a) safe pressurization, and

(b) the means for collecting and disseminating a data base of medical statistics relating to air travel in an effort to assess the adequacy of aircraft systems, design, regulations, standards and practices from a health and safety standpoint, and for the purpose of issuing appropriate FAA administrative advisory circulars and airworthiness directives to correct any deficiencies disclosed.

I am joined in my effort to protect the public health and safety by Senators Cranston, Melcher, and Specter, and my colleague from Hawaii in the House, Mr. Heftel, who has seen fit to introduce his own measure closely aligned, if not identical, to the one we will be considering this morning.

Historically Congress met the mounting problems of coordinating private, commercial, and military use of the nation's navigable airspace with the passage of the Federal Aviation Act of 1958. The legislative history of the Act reveals that the "whole purpose" of enacting the 1958 legislation was "to create a Federal Aviation Agency for better handling of problems of air safety". (104 Congressional Rec. 17457 (1958), remarks of Representative Flynt.)

Subchapter VI of the Act, 49 U.S.C.A. Section 1421 specifically provides that the Administrator "is empowered and it shall be his duty to promote safety of flight of civil aircraft in air commerce by prescribing" such minimum standards, rules and regulations governing the design, materials, construction, etc. of aircraft and air-

craft applicances "as may be required in the interest of public safety". The paramount concern of Congress for safety in air travel is evident in other sections of the Act spelling out the powers and duties of the Administrator. (See Subsections 302(c)(1), 307, 312(c) 602(b), 603, 604, 605(b), and 609(a) of the Act. 49 U.S.C.A. Subsections 1343(a)(1), 1348, 1353(c), 1422(b), 1423, 1424, 1425(b) and 1429(a)). Other parts of the Act pertaining to the function of the CAB, the Secretary of Transportation, the National Transportation Board, and the Chief of the Weather Bureau also continued indications of Congressional concern for the safety of aircraft in flight. (Rauch v. United Instruments, Inc. (1976) 548 F2d. 452.)

Undoubtedly the Congressional objective of safety permeates the Act and underscores Congress primary motive of fostering safe air travel as the basis for enactment of the Federal Aviation Act of 1958.

Current case law has confirmed the intent of Congress in numerous courts across the country, and some jurisdictions have gone as far as creating a federal cause of action under the Act for negligence caused by the breach of a carriers duty to perform it's services with the highest degree of safety citing 49 U.S.C. 1421(b). (Fleming v. Delta Airlines (1973) 359 F. Supp. 339.)

In addition to the duty of an air carrier to perform its services with the highest possible degree of safety pursuant to Congressional intent inherent in the Federal Aviation Act of 1958, case law has also conferred the benefit of this duty to pilots, passengers, crew, and ground maintenance personnel. (French v. CAB C.A. Oakland, (1967) 378 F. 2D. 468; Scott v. Eastern Airlines, Inc. C.A. Pa. (1968) 399 F.2d 14.)

With the exception of certain decisions applying New York law, cases stating the duty and measure of care required from a common carrier of passengers for hire by air assert that such a carrier is under the duty to exercise either a high or the highest degree of care for the safety of its passengers. It must use such care not only with respect to the operation of the plane, but also with respect to it's equipment, maintenance, and the adjustment of all of its parts. (8 Am. Jur. 2d. Aviation, Section 81.) Such common carrier obligations have also been implied by law.

My purpose in recounting the origin of the safety provisons of the Federal Aviation Act of 1958 and current trends in modern law concerning common carrier liability is to emphasize the legitimacy of my safety concerns embodied in S. 1770. It is my firm belief that both passengers and crew, as captive travellers and employees, have a right to the highest degree of safety in the environment in which they travel and work.

In my cursory review of these issues that we are confronting today, I am concerned with the FAA's apparent intentional neglect in the field of aviation health safety. This hearing is by no means the first to be held in addressing such specific issues as ozone. We are well aware of the FAA's own internal record and the record of our counterparts on the House Subcommittee on Government Activity and Transportation.

While I am aware of the airline industry's current economic woes, expecialy with respect to the current costs of fuel, I am distrubed by reports of industry practices that subject unsuspecting

passengers to travelling conditions that could very well jeopardize their health in the interest of saving fuel costs.

In addition, I am distrubed by the continued reports of unhealthy working conditions by flight attendants that have gone uncorrected for years. I am also aware that some 20 years ago cockpit crews were provided their own fresh air system as a result of reports of similar working condition complaints. I find it particularly disturbing how an industry which recognized and accommodated problems reported by one segment of it's employees can remain totally ambivalent to identical compliants from other segments of the same industry.

With respect to the safety of the passengers, I am convinced that little consideration is given to the potential health problems that are inherent in any cross section of the population aboard aircraft.

Our witnesses today reflect a broad spectrum of views and concerns relative to the issues embodied in S. 1770 Without further delay, let me yield to the distinguished Madam Chairman from Kansas, Mrs. Kassebaum.

Senator KASSEBAUM. Thank you.

Senator Goldwater.

OPENING STATEMENT BY SENATOR GOLDWATER

Senator GOLDWATER. Madam Chairman, it is a real pleasure to welcome these witnesses here today to testify on the subject of medical kits on commercial aircraft and the subject that Senator Inouye has just touched on. It is a subject I have been interested in for several years, and like Senator Inouye, I do a lot of air traveling. I made my first commercial flight in 1927. I have been a licensed pilot for 54 years. I still fly, and I have a very deep interest in the whole subject, and particularly airlines that carry people.

Now, ever since it has been brought to my attention—this lack of adequate medical kits—I have made it a point to ask on aircraft that I have been flying on if they have a kit. I understand the FAA requires some kind of a kit. I have been on airplanes where I could not get a Bandaid. I have been on airplanes where I could not get the stuff in my ears to drown out the noise of some drunk behind me. I have not been able to get aspirin when I felt that I could use them. If the stewardess did not have it in her bag, we were out of luck.

I have been told by the stewardee when I asked the question "Where is the medical kit?" Oh, we do not carry one."

I have a great many friends who are doctors who have been on aircraft where emergencies have arisen where they have been able to help. I understand that there is a timidity on their part because of the possibility of being liable. I think we could correct that by proper legislation. What I am getting at is I think every aircraft in this country should be required to have not an expensive kit, certainly not filled with morphine and dope, but the fundamental tools that practically anybody could use or be taught to use and be there in case there is a doctor on board.

I believe every European airline carries these kits, and I think it would be no problem to have the captain of the aircraft lock it in the cockpit and let it remain there until needed.

I am very interested in the subject that Senator Inouye brought up. For example I am not certain there is any humidity in a cabin of an airplane at all. I do not believe there is any humidity in the cockpit. This may have been corrected, but I have been told by psychiatrists who have made studies in these fields that part of the troubles that some of our crews are experiencing, particularly in their psychiatric attitude maybe toward their families or their friends have been caused by long overseas flights of 5, 6, 7, or 8 hours sitting in a completely dehumidified cockpit and drinking coffee after coffee after coffee.

Now, I am not a doctor so I do not know, but I do not drink liquor, and I do not drink coffee, so I do not know, but if doctors report these things, I think maybe the airlines could be induced to spend a few dollars and put a little moisture around in the cabin.

So these are questions that we have to have answered. I think they have gone unanswered for too long a period of time. Madam Chairman, I appreciate very much you, coming from an aviation State, being interested in these problems.

Thank you.

Senator KASSEBAUM. Thank you very much, Senator Goldwater.

I wonder, were the loud drunks just on planes to Arizona?

It is a pleasure to welcome our first witnesses, Mr. Craig Beard, Director of Airworthiness, Federal Aviation Administration, accompanied by Dr. Jon Jordan, Deputy Federal Air Surgeon, and Mr. Bill Brennan, Chief, Air Transport Division of the Office of Federal Operations.

It is a pleasure to welcome you.

STATEMENT OF CRAIG BEARD, DIRECTOR OF AIRWORTHINESS, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY DR. JON JORDAN, DEPUTY FEDERAL AIR SURGEON; AND BILL BRENNAN, CHIEF, AIR TRANSPORT DIVISION, OFFICE OF FLIGHT OPERATIONS

Mr. BEARD. Thank you very much, Madam Chairman and members of the subcommittee.

I am Craig Beard, Director of the FAA's Office of Airworthiness, and with me today are Jon Jordan, Deputy Federal Air Surgeon, on the far right, and Bill Brennan, Chief of the Air Transportation Division of the Flight Operations Office, on my near right.

We are pleased to appear before the subcommittee today to provide you with the views of the FAA concerning S. 1770, a bill relating to air quality standards aboard aircraft, as well as our views concerning the carriage of medical equipment aboard aircraft.

S. 1770 would require the Secretary of Transportation to direct the Federal Aviation Administration to conduct an independent study to determine whether FAA requirements and industry requirements for cabin air quality conform to nonaviation standards. The study, for which funds up to $500,000 would be authorized, would cover quantity and quality of fresh air on board aircraft, humidification, air contamination limits, pressurization, emergency breathing equipment, and measures for extinguishing fires and removing smoke and toxic fumes.

The subject matter of the bill is very similar to a petition for rulemaking the FAA received from the Xenex Corp. That petition, denied by the FAA on March 3, 1981, sought to increase various air quality standards for transport category aircraft. In denying the petition, we carefully reviewed the petitioner's proposal and concluded that aircraft standards for air quality are satisfactory and that there is no evidence suggesting that they pose a safety or health threat to the traveling public. In short, there was no demonstrated need to regulate further, nor conduct additional studies in this area at the present time. I would add that the standards proposed by Xenex, if adopted by the FAA, would have caused the airlines to incur costs potentially adding up to billions of dollars each year. I have attached to my prepared statement, for your review, a copy of the FAA's denial of the petition.

Since the FAA has recently had occasion to review the kinds of issues raised by S. 1770 and is satisfied with the current standards, we do not support the independent study called for by the bill. In our view, the performance of such a study would call for the needless expenditure of funds at a time when fiscal prudence is clearly called for in every activity we undertake.

Let me briefly elaborate on some of the issues covered by the bill. FAA regulations require that passenger and crew compartments must be suitably ventilated and fuel fumes may not be present. Further, the regulations specify a maximum carbon monoxide concentration of 1 part in 20,000 parts of air. Ventilation, of course, varies to some extent from one type of aircraft to another, but a review of aircraft flow rates show that they exceed, and in some cases by a substantial amount, the recommended standards for passenger transport aircraft developed by the American Society of Heating, Refrigerating, and Air Conditioning Engineers. In fact, our review of seven transport category aircraft for purposes of responding to the Xenex petition, disclosed that the ventilation in these aircraft varies from 15 to 25 cubic feet per minute, per person in the passenger cabin, which equates to about 3 to 5 times the ASHRAE standards for passenger transport aircraft. These amounts compare favorably with other recommended minimum standards for nonaviation environments. For example, ASHRAE proposes minimum ventilation rates of 6–10 cfm/person for stores; 15–20 cfm/person for restaurants; 10 cfm/person for in institutional lunchrooms and dining halls; 10 cfm/person for buses; and 12.5–15 cfm/person for ships.

Insofar as humidification aboard aircraft is concerned, the FAA has not prescribed minimum standards nor do we believe this to be an appropriate area for study or regulatory activity since the humidity level aboard an aircraft is, in essence, a matter of comfort, not a safety or health issue.

Senator GOLDWATER. Could I ask you a question at that point? Is there any humidity in a cabin, a pressurized cabin, at 39,000 feet?

Mr. BEARD. Yes; there is some humidity. I can pull out the numbers. I believe it runs between 3 to 30 percent.

Senator GOLDWATER. Three is not enough; 30 is too much.

Senator INOUYE. Would the Senator yield?

Senator GOLDWATER. Yes.

Senator INOUYE. I believe your studies will indicate that much of the humidity in most of the planes results from unsterilized perspiration and breath. Is that what we are providing each other, and is that sufficient?

Mr. BEARD. No, sir, that is not the intent. I believe our position in this matter is that humidity, even though it may be an important comfort factor, is not a health and safety factor, and I believe maybe Dr. Jordan could speak on that better than I could.

But we have an equal concern with the effects on the integrity of the aircraft, when you are dealing with higher humidities. We find that if we attempt to put more humidity in aircraft—in fact, one operator did in fact purchase an aircraft with a humidifier kit in it and found it necessary to take it out because the humidity tends to condense on the extremely cold sidewalls. It collects in the insulation batting. It creates severe corrosion. It accumulates in systems that are exposed to high and cold temperatures, and so there is definitely a tradeoff in getting too much humidity in the aircraft and its effect on the integrity of the aircraft.

So I believe we took a look at it as far as what our rules should contain as being "Does it really affect the safety and health of the passengers or the crew?" and I believe Dr. Jordan can confirm that a lot of the adverse effects that one might suffer from not having humidity in the air are easily compensated for by drinking water or coffee.

Dr. JORDAN. For the most part, sir, those effects are transitory. There is some drying of the mucous membranes and irritation of the eyes, nose, and throat, but above and beyond that, the lack of humidity has no significant adverse health effects.

Senator GOLDWATER. Would you yield?

Senator INOUYE. Certainly.

Senator GOLDWATER. The doctor I referred to who made the psychiatric studies was Dr. Crain, who does work for, I believe, Pan American and maybe other airlines, and the report that I read was that the study was started because of the incidence or the increasing incidences of the breaking up of homes among crewmembers—that they came back from these long flights dehydrated and it had a psychiatric effect.

Is there any credence to that?

Dr. JORDAN. I am not familiar with that particular study, sir, but I would somewhat question conclusions that might be reached that lack of humidity results in psychiatric or psychological disturbances of any great significance.

Senator GOLDWATER. I think it was not the low humidity—it was the low humidity that required the drinking of liquid such as coffee, which we all know pilots drink a hell of a lot of on long flights, that that coffee, the caffeine——

Dr. JORDAN. I see. Well, this is possible, but I think that would be an effect on anyone from drinking large amounts of coffee, and the best recommendation I can make to someone who reacts that way to coffee and the caffeine in the coffee is to change to another liquid.

Senator KASSEBAUM. Mr. Beard, continue.

Mr. BEARD. There is a study conducted by Drs. Anderson, Proctor, Lindquist, and Jansen in 1974 on human response to 78-hour exposure to dry air and they reached the following conclusions:

A, there is no physiological need for humidity of air, and B, there is no change in perception of humidity when the humidity was lowered from 70 percent to 10 percent at 23° C, and when returned to the initial level of 70 percent. This is a quote from a study of four doctors, and I do not know if Dr. Jordan can comment on that further.

Senator GOLDWATER. Could we make that paper a part of the record?

Senator KASSEBAUM. Do you have any comment?

Dr. JORDAN. No, I do not. I see humidity principally as a matter of comfort and not a matter of health. I as a personal matter do have a humidifier on my furnace at home, and I think it probably benefits me, but that may be more psychological than practical or actual.

Senator GOLDWATER. I do not believe it is the lack of humidity itself. It is what the lack of humidity produces—induces one to do. I happen to live in a very, very dry climate. I do not think I am particularly nuts, but I do drink an awful lot of liquids.

Dr. JORDAN. Most people do when they are flying, and I think the air carriers should be commended because they do force liquids on passengers as well as on the crew. I think that at least is one of the reasons.

Senator GOLDWATER. There has to be a related effect. As I say, I do not know anything about it except what I am told.

Dr. JORDAN. I think what you must be talking about is dehydration perhaps rather than humidity, and, of course, people do get dehydrated when the humidity decreases substantially because they lose a lot of water as they breathe and perspire. You compensate for that, of course, by taking in more fluids.

Senator INOUYE. Madam Chairman, I am certain the good doctor is well aware that the most common reason for doctor visitations in the United States is respiratory problems. I think 25 percent of all visitations throughout the United States are due to some respiratory problem. I am certainly also aware that when one goes up to buy a ticket, he does not have to present himself for a physical exam. I travel enough to know that usually 50 percent of the time there is someone around me with some respiratory problem, and I can imagine the discomfort and the physical problems that may be encountered by that passenger. Whenever you go into a hospital with some respiratory problem, they shove humidity by the pound upon you, and for any doctor to say that humidification is not necessary is just beyond me. I think he had better go back to his books again and check with those doctors who deal with respiratory problems.

Dr. JORDAN. Well, I think humidity is a good thing to have, and as I mentioned, I use it in my own home for my own purposes, but I think for a transitory flight on an aircraft, to require significant amounts of humidity in the aircraft is probably not practical nor indicated from a medical point of view. No one could be more allergic than I, yet I fly quite a bit. I do not notice any deleterious effects from flying on my nasal or mucous membranes.

Senator INOUYE. Madam Chairman, I will not interrupt the witnesses from now on until they finish, but just for one observation. I can understand and sympathize if the airlines were the ones complaining about this measure, saying that this will add cost to the consumer, et cetera, but I for the life of me, I cannot understand why the agency is so reluctant to carry on an investigation. And according to the records I have seen, the investigations, if any, have been cursory at best, and the latest one is 1974. A lot of things have happened since then.

Is there anything wrong with checking up on complaints? For example, why do the pilots get better air than the crew and the passengers? If it is good enough for the pilots, is it not good enough for me? I am paying for it.

And you cannot tell me that the air that the pilots breathe ought to be of better quality than I breathe. They are different. The requirements are different. You have regulations relating to the cockpit but not to the rest of the plane. You must have had some reason for setting up special air requirements for the pilot, and I think that the same reasons should apply to the rest of us.

That is where I quit.

Senator KASSEBAUM. Mr. Beard.

Mr. BEARD. I possibly will have an opportunity to answer those questions later as we get into it, and I will be happy to do it. But Senator Goldwater asked me a specific question about the relative humidity aboard aircraft. I gave him a somewhat vague answer of somewhere between 3 and 30 percent, from memory. I was given a bit of information here which comes closer to the humidity that you can typically expect. We are dealing with a pressure cabin of an airline pressurized at an altitude equivalent to 8,000 feet with a dry bulb temperature of 75 degrees Fahrenheit, that would—normally you would experience a moisture content in the cabin air of 21 grams per pound, which would be equivalent to a relative humidity of about 12 percent.

I will continue on with my statement, then.

With respect to emergency breathing equipment, FAA regulations provide for the use of oxygen in emergencies but this provides little protection from toxic fumes. I should note, however, that toxic fumes do not present a problem in normal operations.

In the event of an in-flight fire which can cause toxic fumes, we believe the best remedies are improvements in cabin materials to reduce these fumes; specifically, fire blocking materials, improved fire extinguishment, and improved smoke removal. We have recently developed improved fire extinguishment techniques using Halon extinguishers, and this combined with recently developed fire blocking layers for seats should break the fire chain and allow extinguishment of fires that might break out onboard transport airlines.

We presently have a research program to study means of improving the removal of smoke and toxic fumes resulting from in-flight fires. This program includes full scale tests in a pressurized 707 and the necessary development of a standardized smoke generator which accurately simulates the smoke density resulting from typical airplane fires. Consequently, additional mandated studies in

these areas would, in our opinion, be either duplicative or unnecessary.

Current FAA regulations for pressurization require that the cabin altitude not exceed 8,000 feet for pressurized airplanes. Medical information indicates that this requirement accommodates the vast majority of the population, including those persons mildly symptomatic and with cardiorespiratory problems. Efforts to apprise the remaining portion of the population of the potential risks of flying, such as in the American Medical Association article mentioned later in my statement, are useful. But to require changes in aircraft structure for purposes of changing pressurization standards to potentially accommodate the limited numbers of persons who otherwise should not fly would be exceedingly costly and not cost beneficial, in our judgment.

Let me turn now to the subject of carriage of medical equipment aboard commercial aircraft. Before discussing our views on this subject, I would like to give you an indication of the number of medical incidents which occur onboard aircraft, to give you some perspective on the issue. In the 10-year period from 1971 through 1980, the scheduled air carriers transported a total of 2,311,343,000 passengers. Of that number, only 7,789 passengers and crew members were involved in incidents reported to the FAA, or less than four ten-thousandths of 1 percent.

These incidents included injuries which occurred while taxiing as well as in-flight items ranging from coffee burns to heart attacks. During this same period, U.S. scheduled airlines made a total of 50,145,033 departures, of which only 868 flights experienced some type of medical incident, for a percentage factor of two thousandths of 1 percent, or one medical incident per 100,000 departures.

The FFA's regulatory standards regarding the carriage of medical equipment aboard aircraft are, admittedly, limited. Essentially, we require only first-aid-type equipment such as bandages, burn ointment, splints, and the like to be carried aboard aircraft for treatment of injuries likely to occur in flight or in minor accidents.

Because of the nature of our requirements, the Public Citizen Health Research Group petitioned the FAA to expand the carriage of medical equipment aboard aircraft. We have recently denied that petition for rulemaking. A review of our statutory authority—to regulate in the interest of air safety—indicates to us that absent a safety reason calling for special attention in this area, our regulatory authority to require further medical equipment is circumscribed by the need to relate the use of that equipment to some aviation-induced problem.

For example, equipment, such as first aid equipment which can reasonably be related to an aviation induced injury such as might occur from turbulence can be required by the FAA. The authority to go beyond this type of requirement, however, and to impose additional requirements on the airlines to deal with general health emergencies is, at best, highly suspect and more probably not conferred on the FAA by the Federal Aviation Act of 1958.

Senator GOLDWATER. Pardon me. Aren't you getting to a point where we should consider legislation to remove any liable possibilities from a doctor who might be onboard the aircraft, who at present has some reluctance to treat a passenger? Isn't that about what

you are saying? Because I don't buy the argument that even if you have one-tenth of one-millionth of 1 percent sickness on an aircraft requiring some kind of medication, that you shouldn't carry medical equipment.

I have never had an accident on any airplane of mine; I carry medical equipment. Railroads carry them, buses carry them, anybody with a half a pound of brains is going to put them in their car someplace. Now, what is wrong with an airplane to carry at least a bandaid or a wad of cotton and some aspirin?

Now, you just go take any flight you want to, and I will bet you a good beer you are not going to find that equipment onboard.

Mr. BEARD. Senator, we do have very explicit rules which do require the carriers to carry first aid kits, which are designed to address the type of injuries——

Senator GOLDWATER. You had better start checking up, because I have checked, and checked, and checked and I have not found a one. And I think it is important. In fact, I am considering legislation to accomplish this. I don't want to. I think it should be done as part of your duties. In fact, I think it should be done as a voluntary matter by every airline in America.

Bicycles carry first aid kits. What is wrong with an airliner carrying at least a little tin box with a red cross on it that has something in it besides a splint that will fit your finger, and a little cotton and a bandage? It doesn't have to elaborate. I am not talking about $500 kits. I am talking about something a captain carries up in the cockpit, and a passenger gets sick.

I had an occasion just a year ago. A good friend of mine who is an orthopedic doctor, and should know about these things—a 300 pound man got a piece of steak caught in his throat. No equipment. He even tried a coat hanger. It was lucky that the pilot was near a big city and he got it down, but if he was over the ocean, that man would have been dead. And those are the things that I complain about; just simple little things.

And you might even consider having the girls going back to maybe taking a half hour course in first aid. They used to be nurses.

Mr. BEARD. Senator, I believe a lot of what you are suggesting is both required and there, and it is unfortunate if you did ask a flight attendant for a first aid kit and she couldn't find it. There must be some problem in the training program in that particular carrier. But there are first aid kits in the cabin. The flight——

Senator GOLDWATER. Well, I have found the captains didn't know where they were. If the captain doesn't know where they are, then we are in bad shape.

Mr. BEARD. Apart from our perceived limited authority in this area, we would also note that there are some issues which need consideration before concluding that the carriers should voluntarily carry more medical equipment. Current FAA rules require airlines to train their personnel in the use of first aid equipment, as well as how to cope with medical emergencies that may occur in flight.

One important issue which undoubtedly is of concern to the airlines is that of liability. Airline training of crew members to deal with medical emergencies can only go so far. How then can the air-

lines assure that a crew member with limited medical training or, for that matter, a volunteer passenger is competent to diagnose the problem and correctly use the equipment made available by an airline? Moreover, there are clearly cases in which attempted treatment by other than a specialist with sophisticated equipment may aggravate an individual's medical condition rather than improve it.

I would also observe that a special report of the board of trustees of the American Medical Association was adopted by the AMA's house of delegates at a December 6–9 meeting. That report stated that:

> The Commission on Emergency Medical Services believes that the first aid kits currently carried aboard commercial aircraft are satisfactory. The addition of potent drugs and surgical instruments to these first aid kits could create a potential for misuse by unqualified persons during inflight medical emergencies.

The board of trustees then went on to recommend against the carriage of potent drugs and surgical instruments on commercial aircraft and to recommend that the AMA continue to inform physicians on how to care for inflight medical emergencies aboard commercial aircraft.

I would add that we strongly support the efforts of the AMA to better educate its membership on the impact of air transportation on a patient's medical condition. In fact, we have purchased reprints of an article entitled, "Medical Aspects of Transportation Aboard Commercial Aircraft," published in the February 19, 1982 AMA Journal, to disseminate to our aviation medical examiners throughout the country to further their knowledge in this area.

To sum up on this issue, Madam Chairman, we believe that it would exceed our regulatory authority to require airlines to carry equipment to deal with general health emergencies which might arise in air transportation. Beyond that, however, we have serious reservations, echoed by others who have given this issue thought, about the desirability of the airlines carrying such equipment. Of course, the air carriers are free to carry additional equipment should they so choose.

That completes my prepared statement. My associates and I would be pleased to respond to questions you may have at this time. Thank you very much.

[The denial of petition follows:]

UNITED STATES OF AMERICA, DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION

In the matter of the petition of Xenex Corporation to amend Sections 25.831 and 121.219 of the Federal Aviation Regulations, Regulatory Docket No. 20351.

DENIAL OF PETITION

By letters dated May 8 and May 23, 1980, Bertil Werjefelt, President, Xenex Corporation, 1400 Kapiolani Blvd., Suite C–4, Honolulu, Hawaii 96814, petitioned the Federal Aviation Administration (FAA) to amend §§ 25.831 and 121.219 of the Federal Aviation Regulations (FAR) to improve airplane passenger and crew compartment air quality standards.

Section 25.831 states, in pertinent part, that each passenger and crew compartment must be ventilated and that each crewmember must have at least 10 cubic feet of fresh air per minute. Also, passenger and crew compartment air must be free of harmful of hazardous concentrations of gases or vapors. Maximum permissible concentrations of carbon monoxide and carbon dioxide are specified.

Section 121.219 states, in pertinent part, that passenger and crew compartments must be suitably ventilated and fuel fumes may not be present and also specifides a maximum carbon monoide concentration of one part in 20,000 parts of air.

In support of its petition, Xenex Corporation (Xenex) presents a number of arguments which are discussed in the following paragraphs.

The petitioner contends that crew and passengers are subjected to health hazards while flying as a result of inadequate ventilation. In addition, fresh air ventilation rates on board airplanes carrying passengers are only 10 to 20 percent of the "fresh air ventilation" required by law for minimum acceptable indoor air quality in a nonaviation environment. The petitioner does not substantiate the health hazards to which it believes the crew and passengers are being subjected, nor does it provide information regarding the extent of the health problems being encountered. The petitioner does not explain how it arrived at the conclusion that passenger-carrying airplane ventilation is only 10 to 20 percent of that required by law for nonaviation environments. The petitioner also fails to identify the law to which the reference is made.

Xenex claims that the ventilation recommended by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) for indoor nonaviation environments should apply to passenger transport aircraft. The petitioner fails to explain why another ASHRAE standard which contains recommended ventilation [1] standards for passenger transport aircraft should not be used. ASHRAE 1978 Applications Handbook, Chapter 9—Aircraft, states in part, "A portion of the cabin air may be recirculated, but it should be filtered and purified if it is a large percentage of total ventilation or unless it is recirculated for limited times only. The recommended ventilation rate is 2.4 liters per second (1/s) per passenger and 14.2 1/s for cockpit crew members." The recommended ventilation rate of 2.4 1/s equates to approximately 5 cubic feet per minute (cfm), and 14.2 1/s is approximately 30 cfm. The current rule requires for each crewmember a minimum of 10 cfm of fresh air plus additional ventilation to perform his or her duties without undue discomfort or fatigue. A review of the ventilating characteristics of the crew cabin is seven current transport airplanes reveals that the minimum ventilation rates vary from 70 to 150 cfm per crewmember with air changes ranging from 20 to 87.8 per hour which exceeds the ASHRAE recommendation.

Xenex proposes fresh air ventilation at 35 to 65 cfm/person. The petitioner does not provide justification for such large quantities of fresh air flow. For buses and trains, the ASHRAE indicates that 20 to 25 percent outdoor air is adequate. Even using the minimum recommended ventilation for cocktail lounges (30 cfm/person) as an appropriate standard for transport aircraft, it would require only 6 to 7½ cfm/person of fresh air rather than 35 to 65 cfm/person as proposed. The petitioner proposes that filtered recirculated air shall never exceed 7 cfm/person. No support for this proposal is included in the petition.

A review of the ventilating characteristics of seven current transport airplanes reveals that the ventilation varies from 15.2 to 25.7 cfm/person in the passenger cabin or 3 to 5 times that recommended by ASHRAE. When cabin air is recirculated in these airplanes, appropriate air conditioning is accomplished.

The petitioner proposes that uncontrolled aircraft leakage be less than 20 percent. The proposal is not clear because the petitioner does not indicate what criteria requires that the leakage must be less than 20 percent.

Xenex proposes that contaminants be limited to 0.1 of the threshold limit values as established by the Amercian Conference of Governmental Industrial Hygienists. Xenex proposes that cabin air be monitored for contamination caused by pathogens. Pathogens are any micro-organisms or virses that can cause disease. No justification for this proposal is presented, nor is the action identified which is to be taken by an air carrier if such monitoring is instituted.

The petitioner proposes that the air on board shall be free of offensive odors. The issue of offensive odors involves subjective evaluation and is not an issue for which safety rulemaking is appropriate.

Xenex proposes that, at all times, the relative humidity in aircraft cabins be maintained between 30 and 50 percent. It is also proposed that water used to humidify the cabin be free of organic and chemical compounds in accordance with acceptable public health standards for potable water as defined by the American Conference of Governmental Industrial Hygienists. Xenex further proposes that the vapor in the air on board transport aircraft shall be composed of no more than 20

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[1] Ventilation. The process of supplying or receiving air by natural or mechanical means, to or from any space. Such air may or may not have been conditioned. American Society of Heating, Refrigerating, and Air Conditioning Engineers—Handbook of Fundamentals, Terminology.

percent unsterilized perspiration and expiration originating from occupants on board.

Xenex fails to show that there is a physiological need for such high levels of humidification during flight. Although human comfort may be affected by humidity, no evidence is presented by the petitioner to allow the conclusion that humidity, or lack of it, causes health problems in normally healthy people. Regarding the purity of water used for humidification, the petitioner has not shown that the quality of water used in humidifying systems has ever affected passenger or crew safety. The petitioner's proposal that water vapor not be more than 20 percent unsterilized perspiration and expiration is not supported. No evidence was found that such a requirement exists or is needed today for persons in any environment.

The Federal Aviation Administration published the Xenex Corporation petition for rulemaking, verbatim, for public comment, in the Federal Register (45 FR 41962) on June 23, 1980. All communications received on or before August 22, 1980, were considered by the Administrator before this action was taken. The FAA received comments from 29 individuals, organizations, and companies in response to the petition. The majority of these supported either the petition or the intent of the petition without taking a position on the particular levels for humidity, contaminants, or fresh air circulation rates. Two commenters cite illnesses, flu, and chicken pox, contracted after an airline flight, which they attributed to poor air quality on the airplanes. Several comments were made that the fresh air ventilation standards for aircraft are not equal to those of other public or non-aviation environments. None of these comments were substantiated by information or data.

There were comments from five organizations and companies opposed to the petition. The Aerospace Industries Association, (AIA) contends that implementing the proposal would cost the airlines $633 million per year for the Boeing 727 aircraft fleet and $1.319 billion per year for the Boeing 747 aircraft fleet. This contention was supported by a detailed cost analysis. In addition, data were submitted which show that the ventilation rates and number of outdoor air changes per hour for seven different air carrier aircraft exceeds the most stringent recommendations for public gathering places, specifically night clubs.

The petitioner submitted a general rebuttal to the cost estimate from the AIA. However, while recognizing that the proposals would be costly, the petitioner did not offer any counter cost estimates nor did it present data to show that any retrofit of additional equipment is justified in the interest of aviation safety. In this connection, it may be noted that FAA regulations do not preclude installation of additional air conditioning, filtering, and humidifying equipment that meets airworthiness standards should an airline elect to do so in the interest of increasing passenger comfort.

In consideration of the foregoing, I find that the petition does not justify instituting the rulemaking procedures requested by the petitioner. Therefore, in accordance with rulemaking procedures of Part 11 of the Federal Aviation Regulations, the petition of the Xenex Corporation to amend §§ 25.831 and 121.219 of the Federal Aviation Regulations is hereby denied.

Issued in Washington, D.C., on March 3, 1981.

Senator KASSEBAUM. Senator Inouye.

Senator INOUYE. Is it your understanding that S. 1770 requires you to change your regulations?

Mr. BEARD. No, sir, it is not. We interpret it as a requirement to study the subject further, and that we would be given certain moneys to do that. And I believe our position in the matter is that we are dealing with areas that we are already studying in R. & D. projects; hence, we do not need it. It would be redundant. We are not asking for the additional money in these areas. Or, they are subjects that we have already studied considerably and we feel that it would be a waste of the public resources.

Senator INOUYE. Why is that we persistently receive information that the studies have not been made, or if made, have been very shallow?

Mr. BEARD. I do not know why you received that information. That certainly is not our view.

Senator INOUYE. Well, on the amount of humidity, I believe most passengers come from areas where the percentage of humidity is about 30 to 60 percent, isn't it?

Mr. BEARD. That is probably about right, yes, sir.

Senator INOUYE. And isn't it true that the typical humidity that one would find in an aircraft, which is a mixture of perspiration and breath, is about 5 to 10 percent?

Mr. BEARD. No, sir, I believe the figures that we were dealing with are more typically in the 12-percent area.

Senator INOUYE. Twelve percent?

Mr. BEARD. Twelve-percent area.

Senator INOUYE. I understated that by 2 percent, then. Doctors all tell me that without exception, this type of humidity on a 4-hour trip would cause drying up of mucous membranes, which would make a person that much more susceptible to respiratory diseases, isn't that correct, Dr. Jordan?

Dr. JORDAN. Yes, sir, I think that is principally in theory, of course. I do not know of any studies that clearly document the relationship between the dryness of mucous membranes and the development of disease.

Senator INOUYE. Why do all these doctors say so if it is not in practice? They seem to know about it.

Dr. JORDAN. I am not sure that all doctors do say that, Senator.

Senator INOUYE. But enough of them do.

Dr. JORDAN. Well, quite a few do, yes.

Senator INOUYE. Should it be a matter of concern?

Dr. JORDAN. Well, I think that if I had a choice between environments, I would take one that had some humidity in it, obviously.

Senator INOUYE. Would you consider 12 percent sufficient for a 4-hour flight?

Dr. JORDAN. Preferably, it should be higher than that, Senator. I would suggest 18 or 20, but I would not go above that.

Senator INOUYE. So we do not want to study this?

Mr. BEARD. Senator, there was a study conducted by the Society of Automotive Engineers that they have published in an Aerospace Information Report, AIR-1609. It discusses the physiological effects. It also discusses the tradeoff in aircraft design, and I believe one of the points we were trying to make earlier is that we feel that it is more of a comfort item than a safety item, and that if we begin to get into the higher humidities that you might suggest over 12 percent and above, we do run into some very serious aircraft design problems.

The moisture in the air, the external wall of the aircraft at a high altitude is extremely cold. If there is a lot of humidity in the air, this moisture condenses out and it does bad things to the aircraft structure and it does bad things to the aircraft systems. The SAE report even refers to incidents where the moisture will condense out and freeze as ice, and if you are going through a series of short hops, the ice accumulates and leaves weight in the aircraft that cannot be calculated for and cannot be known. It seeps into the seams of the aircraft. You have corrosion problems, it gets into the systems and the avionics areas that are in the colder areas of the aircraft.

So there is very definitely a tradeoff. If, on the one hand, we were to regulate a humidity value for purely a comfort purpose, we could do bad things to the structural integrity and the system integrity of the aircraft.

Senator INOUYE. What is the rationale for regulating the quality and quantity of air in a cockpit and not doing so for the rest of the plane?

Mr. BEARD. We do provide minimum flow rate limits for the cockpit, and I believe the rationale—and this goes back quite some time—is that it is much more important to keep the crew that is flying the airplane alert than all of the passengers. However——

Senator INOUYE. In other words, if the pilot had to breathe the air in the cabin, he would not be able to do a good job.

Mr. BEARD. No, sir, that is not correct.

Senator INOUYE. Then why do you change it?

Mr. BEARD. In assessing the problem—and we did this in most of our regulations, and particularly in the last 2 years—we really look to see if the industry is coming up to their social responsibility before we impose a regulation on them. And if you look at the air flow rates and the air exchange rates in both the flight crew cockpit and the passenger cabin, you will find they far exceed that which we have suggested in our regulations. These design standards the manufacturers have imposed upon themselves.

The thing that really drives, in my view, the fresh air flow and exchange rates, the designing factors, are maintaining the pressurization and the ability to maintain 8,000 feet, and another factor is purely passenger acceptance or appeal of the aircraft.

If the manufacturer were to develop an aircraft that lacked passenger appeal, the airlines would not be able to use it successfully, and the manufacturers would not be able to sell it, and this has been a much more compelling factor to these folks than any regulation that we may have written for safety standards. And as a result, the flow rates that we have in aircraft and the exchange of air with fresh air far exceed, or at least exceed, the best that you are going to find in the nonaviation community, and they certainly far exceed the minimum 10-cubic-foot per minute per person, I believe, that is suggested by FAR-25.

Senator INOUYE. Madam Chairman, I wish to associate myself with the concern expressed by Senator Goldwater on the matter of medical kits on aircraft. I believe I am correct in that each year we have a couple of hundred people die on aircraft.

Mr. BEARD. Can you speak to that, Dr. Jordan?

Dr. JORDAN. Yes, sir, there are a number of people who do die onboard aircraft. I think it equates to about 1 per, say, 6 million passengers carried.

Senator INOUYE. And I gather from something I read that European aircraft carry medical kits that run about $250 per. Is that a really expensive item?

Dr. JORDAN. Some European carriers do. Most of the kits—and I do not know exactly what their costs are, but most of the kits that I have seen that would satisfy the needs of what people, let's say, physicians wish to have available to them when flying and attending someone who has become incapacitated for some reason, averages around $500 to $600.

Senator INOUYE. Isn't the expenditure of $500 to $600 justified if it is going to save 200 lives?

Dr. JORDAN. I do not think there is any documentation—at least I am not aware of it—in which the absence of a medical kit onboard an aircraft has resulted in the death of a passenger.

Senator INOUYE. I think you had better stay here and listen to the testimony of other people. I think they will testify otherwise.

I fly around, and I do not often ask for medical kits, but there was a time I needed something and by good fortune, my seat mate was a physician, so he happened to have a little kit himself.

Thank you, Madam Chairman. Madam Chairman, may I submit questions for study and response by the witnesses?

Senator KASSEBAUM. Certainly.

There has been comment here on the air circulation levels and the ozone that the FAA has set. But do you monitor those levels? Is there a consistent monitoring system?

Mr. BEARD. No, Senator, we do not monitor them during the operation of the aircraft except in the ozone area. Now, recently we did issue explicit regulations for both aircraft design and aircraft operation which does discuss ozone levels and does discuss explicit numbers, and those are periodically monitored.

But in just the general ventilation issue, the design of the aircraft is submitted to us, the ventilation rates are submitted to us. We do have an opportunity to review those. We do have regulations which, even though they do not give specific numbers, give us the opportunity to subjectively say, "That is not good enough." Our people do typically use the ASHRAE standards and we are aware of the manufacturer's design standards.

And with what we see in the industry today, we just do not feel that an explicit regulation in Part 25, to be more specific than what we have, will really contribute a lot. I might touch on a number I have here, that today the current industry design goal for the passenger cabin is 20 cubic feet per minute per passenger, with 12 to 15 exchanges of air per hour in the passenger cabin, and this is not untypical of what we have experienced with older designs.

Senator KASSEBAUM. And you monitor that?

Mr. BEARD. In the original certification of the aircraft, we do in fact, not to determine that they meet those standards, but we determine that the ventilation is adequate, that it is free of fuel fumes. We do measure the specifics on carbon monoxide and other contaminants that might be dangerous to the passengers.

It is more of a subjective evaluation than it is a detail ad one against numbers set in a standard.

Senator KASSEBAUM. But would it not be of some value, not necessarily to establish more detailed regulations, but to have perhaps a more consistent monitoring pattern for those that are in existence, even a yearly monitoring of planes in flight?

Mr. BEARD. Senator, once the design is fixed and the capability is there and they are operating, I believe you can remain relatively sure that that will hold, because, as I mentioned before, one of the big driving factors in the ventilation and air exchange is maintaining the cabin pressure to where you do not go above 8,000 feet. Now, we have explicit cabin pressurization requirements in FAR-

25 which tend to drive this and in effect, assure that you do have these flow rates. Otherwise you would not be able to maintain the pressure in the airplane to meet the pressurization requirement.

Senator KASSEBAUM. On the medical care, perhaps you addressed this. I did not catch it. But are the flight crews in their training given basic cardiac life support training?

Mr. BEARD. I am an old structural engineer. I will have to defer to my colleagues on that subject.

Dr. JORDAN. There is no FAA requirement for that specific type of training. I think you are talking about cardio-pulmonary resuscitation. We have no specific requirement. But most of the carriers in their training programs do provide that kind of training.

Senator KASSEBAUM. It would seem to me that that would be very beneficial in this day and age.

Dr. JORDAN. Yes; I think that it probably would be. There are difficulties, technical difficulties, of course, of providing cardio-pulmonary resuscitation on board an aircraft. There are some real technical difficulties with doing that. That does not mean that it is not possible nor indicated when the circumstances arise.

Senator KASSEBAUM. Thank you.

Senator Inouye, do you have any more?

Senator INOUYE. I have just one question. What is your position on maintaining an aircraft for emergency smoke masks or hoods?

Mr. BEARD. Our current position is, while we do require it for crews that might be involved in combating fire or an in-flight emergency situation, our current position relative to the passengers is that it is not necessary, or if we are talking about the post-crash fire it could actually become counterproductive in the effort for rapid evacuation of the aircraft, and the confusion that the passengers might have in trying to determine how to don these things and the entanglement of trying to get off the aircraft.

Our experience has caused us to believe that first priority should be to getting those passengers off the aircraft immediately. We do have a very serious concern, regarding smoke hoods and things like that being used, of the counterproductive effect on getting people off the aircraft.

Senator INOUYE. I presume you have studied the case that is now pending involving Saudi Airlines, where about 290 or so passengers died?

Mr. BEARD. Yes, sir, we have.

Senator INOUYE. And I gather that the cause of death was not fire itself, but the smoke which took away the oxygen, and the suit is based upon that?

Mr. BEARD. I believe that is—I am not familiar with the suit. I am not involved in that. We have been following the accident investigation and we have participated in assisting the National Transportation Safety Board, who in turn assisted the Saudi Government in that review.

I believe there were extraneous circumstances in that accident that would have probably precluded smoke hoods from doing any good there at all. I believe the accident report will reveal that there was bad crew performance, there was bad fire and rescue performance. In fact, I happen to have a copy of the Saudi report

with me, and let me read just a brief paragraph from their synopsis.

Senator INOUYE. That is issued by the Saudi Government?

Mr. BEARD. That is correct.

Senator INOUYE. The owner of the airline?

Mr. BEARD. No, sir. This is the president of civil aviation in Saudi Arabia.

Senator INOUYE. Who owns the airline?

Mr. BEARD. Well, in that case it is probably the Saudi Government.

Senator INOUYE. The same people?

Mr. BEARD. Yes. But let me read what they then said of themselves:

> Factors contributing to the final fatal result of this accident were:
> One, the failure of the captain to prepare the cabin crew for immediate evacuation upon landing and his failure in not making a maximum stop landing on the runway, with immediate evacuation;
> Two, the failure of the captain to properly utilize his flight crew throughout the emergency;
> And three, the failure of crash, fire and rescue headquarters management personnel to ensure that its personnel had adequate equipment and training to function as required during an emergency.

I believe from the information we have, the airplane was on the ground and should have been evacuated and was not for nearly some 15 to 20 minutes, which is a little bit much to be asking of a smoke hood. And there was so much more that could have and should have and would have been done, we believe, in a U.S. situation.

Senator INOUYE. Did the captain and the crew all die?

Mr. BEARD. Yes, sir, that is correct, they all did.

Senator INOUYE. Well, is it not true that they were not in condition to open up the doors?

Mr. BEARD. We do not believe that to be the case, sir. The flight crew repeatedly suggested, the cabin attendants repeatedly suggested to the flight crew that they should be evacuating the aircraft. It spent quite some time on the ground, even taxiing away in a very casual manner, before they shut down the engines.

It is a sad, sad report. We do not really believe that it is a point on the data curve, though, that could be held up as vindicating the argument for smoke hoods.

Senator INOUYE. I am just curious to find out where they got that evidence, because I do not think there were survivors to give that evidence.

Mr. BEARD. There were cockpit voice recorders. There were flight data recorders. There were witnesses on the ground that were involved with the crash, fire, rescue people.

Senator INOUYE. Thank you.

Senator KASSEBAUM. Thank you, Mr. Beard and Dr. Jordan and Mr. Brennan.

Mr. BEARD. Thank you very much.

[The following information was subsequently received for the record:]

QUESTIONS OF SENATOR INOUYE AND THE ANSWERS THERETO

Question 1. Please state your full name, title, work address and telephone number where you can be reached at the Federal Aviation Administration (FAA).

Please identify the name(s) and title(s) of all persons assigned and/or assisting in the preparation of the responses to these interrogatories.

Please identify the authority by which you are answering these interrogatories, and whether you are answering them on behalf of and with the full knowledge and approval of the FAA and its Adminstrator. If not, please identify the person(s) whose views are expressed herein?

Answer. J. Lynn Helms, Administrator, Federal Aviation Administration, 800 Independence Avenue SW., Washington, D.C. 20591, Telephone: (202) 426-3111.

The responses to these questions are given under the authority of the Federal Aviation Act of 1958. Many persons from offices of my staff assisted in the preparation of the answers to these questions. These offices are: Associate Administrator for Aviation Standards; Office of Airworthiness; Office of Flight Operations; The Transport Airplane Certification Directorate; The Office of Aviation Medicine; The Office of Environment and Energy; The Office of Chief Counsel.

Question 2. Please identify the materials, tests, investigations, surveys, case studies, and other sources that form the basis of the FAA's position that "there is no demonstrated need to regulate further nor conduct additional studies in this area at the present time."

Answer. (a) FAA Regulatory Docket No. 20351 (Xenex Corporation petition for rulemaking).

(b) American Society of Heating, Refrigerating, and Air Conditioning Engineers 1978 Application Handbook and Product Director, page 9.2 of Chapter 9 (attachment to question 18).

(c) Information from our Transport Airplane Certification Directorate showing ventilation rates of most transport airplanes (contained in question 18).

(d) SAE Aerospace Information Report 1609, Aircraft Humidification.

Question 3. The FAA states that current regulations require that passenger and crew compartments must be suitably ventilated. Please describe in detail the meaning the FAA attributes to being "suitably ventilated."

Answer. The term "suitably ventilated" is found only in section 121.219 of Part 121 of the Federal Aviation Regulations (14 CFR 121.219) which reads:

"§ 121.219 Ventilation: Each passenger or crew compartment must be suitably ventilated. Carbon monoxide concentration may not be more than one part in 20,000 parts of air, and fuel fumes may not be present. In any cases where partitions between compartments have louvers or other means allowing air to flow between compartments, there must be a means convenient to the crew for closing the flow of air through the partitions, when necessary."

Part 121 is an operating rule, not a design certification standard. Airplane design standards, such as the above section 121.219, are only included in Part 121 for compliance by very old designs, e.g., DC-3, which may have been certificated to much less stringent design certification standards. For later aircraft designs, the more stringent certification standards contained in 14 CFR 25.831 take precedence over the minimum operational requirement of Part 121. For a description of current certification practices, see our response to question 18.

Question 4. The FAA testimony also states that regulations specify a maximum carbon monoxide concentration of one part in 20,000 parts of air. This concentration amounts to 50 parts per million (ppm). Please state whether the FAA finds this level reasonable and prudent?

Answer. The FAA finds this level to be reasonable and prudent. The FAA does not do health research and uses Federal guidelines for health effects established by other agencies and federal advisory groups. These are then used as a basis for policies related to the aircraft environment.

According to the Occupational Safety and Health Administration (OSHA), carbon monoxide concentrations shall not exceed an 8-hour time-weighted average of 50 parts per million in any 8-hour work shift of a 40-hour work week (Code of Federal Regulations, Title 29, § 1910.1000).

The Environmental Protection Agency (EPA) has established national ambient air quality standards for carbon monoxide of 9 parts per million, maximum 8-hour average and 35 parts per million, 1-hour average neither to be exceeded more than once per year (Code of Federal Regulations, Title 40, § 50.8).

Question 5. Please identify the materials, tests, case studies, medical and technical expertise and other sources upon which the FAA believes that minimum humidification standards is not an appropriate area for study or regulatory activity, since the

humidity level aboard aircraft is in essence a matter of comfort not a safety or health issue.

Answer. The FAA's opinion is derived from the fact that many areas of the world which have desert-like climates or continuous cold and snow over long periods of time are populated by persons who have no significant health problems related to lack of humidity.

As pointed out in the U.S. Naval Flight Surgeons Manual, Second Edition 1978, prepared by the Naval Aerospace Medical Institute and Bio Technology, Inc., the low humidities encountered in high flying pressurized aircraft present a chronic but not a serious problem. Since most flights are of short duration, even the frequent air traveller is exposed to low levels of humidity for only short periods of time.

While many publications, e.g., Ross McFarland's book entitled Human Factors in Air Transportation, McGraw-Hill Book Company, Inc., New York, 1953 and NASA Bio Astronautics Data Book, Second Edition, NASA, Washington, D.C., 1973, have referred to discomfort caused by dryness of the nasal passages, a study by Andersen, Lundquist, Jensen, Proctor, entitled Human Response to 78 Hour Exposure to Dry Air, Arch. Environ. Health, 29:319–324, 1974, is the only scientifically designed evaluation of the effects of dry air on nasal mucous flow rate, nasal resistance, forced vital capacity, skin resistance, and an index of discomfort in 8 young healthy men exposed to clean air at 23° C. in a climate chamber. After 27 hours at 50 percent relative humidity they lived for 78 hours at 9 percent relative humidity, and then returned to the initial level of 56 percent relative humidity for 20 hours. No significant changes were observed in the nasal mucous flow rate throughout the experiment nor did a 10-fold increase in nasal respiration during 20-minute periods of exercise in the dry air cause any change in mucous flow rate. No changes were observed in nasal or tracheobronchial resistance. The subjective index of discomfort for the subjects varied widely and related poorly to the humidity conditions. On the average all subjects said they were in the index comfort range. No discomfort was reported from the body surfaces, and skin resistance did not change. This study indicates that there is no physiological need for humidification of the air.

Of interest is the fact that most of the attention to the problems of relative humidity has been directed at the discomfort caused by high levels of relative humidity in aircraft parked on the ground during stopovers or at the initiation or termintion of a flight.

It is also worthy of note that it is in the interest of sound engineering to keep humidity levels in aircraft in flight as low as possible. A balance is required between comfort which is directly related to the temperature and humidity of inspired air and engineering requirements to limit freezing and corrosion.

Other agencies of government—NASA, the Air Force, the Army, and the Navy—have missions in space and worldwide which place their personnel at higher risk for low humidity levels than passengers and crew of commercial airlines. Nonetheless, none of these agencies have identified health or safety factors independent of engineering considerations which can be specifically related to the humidity levels aboard their aircraft.

SAE Aerospace Information Report 1609 gives information regarding the design, physiological effects on crew and passengers, evalution and discussion of techniques, problems and penalties of aircraft humidification systems.

Health is determined by a large number of separate but interrelated factors which are difficult to quantify in multifactorial situations such as those occasioned by short flights in commercial aircraft. Hence, the FAA has been unable to identify health or safety issues and is of the opinion that the only one related to humidification is that of the comfort of passengers and crew.

Question 6. Since in some cases 95 percent of the humidity on board an aircraft is unsterilized sweat and breath from occupants on board, and this moisture is in some cases recirculated for prolonged periods, given Dr. Elliot Dick's testimony on the case study of the spread of a contagious disease in an aircraft where he noted that more than 70 percent of the aircraft occupants were seriously affected by disease spread in the moisture in the air, does the FAA still maintain that humidity on board aircraft is "not a safety or health issue"?

Please identify the sources of information forming the basis of the FAA response to this question.

Answer. Early in his testimony Dr. Dick makes the following statement ". . . cold, influenza and other similar respiratory ailments are caused by microbes—chiefly viruses—not by cold, fatigue, low humidity or the various other factors cited as "cold causing." He refers to the extreme difficulty of conducting good experimental studies. His own testimony was based solely upon a study by Moser, et al. of the Alaska Investigation Division, Bureau of Epidemiology, Center for Disease Control,

Anchorage, AK, published in the American Journal of Epidemiology, 110: 1-6, 1979. The circumstances suurounding Moser, et al.'s study made possible the obtaining of good epidemiologic data. However, they were so extreme that it is doubtful that they have applicability to the question posed. First of all, as shown by the data in Moser, et al.'s study, the highest attack rate occurred among those persons who volunteered to stay on board the aircraft after an engine failure had required its returning to the terminal at Homer. The one index passenger who had the flu stayed on board the aircraft for a period of approximately 3 hours. The aircraft did not carry the passengers from Homer to Kodiak. They were eventually flown to Kodiak in two other aircraft.

While the Boeing 737 was on the ground at Homer, the ambient temperature in Homer was −1.7°C. The ventilating system of the aircraft was turned off. For much of the time on the ground, the doors were closed, and even when opened, passengers made no complaint about cold weather, indicating that there was very little ventilation of outside air through the aircraft. These conditions are not at all comparable to what would be found during an aircraft flight. In the article, Moser, et al. suggests that the proper operation of the air circulation equipment and the isolation of the ill passenger might have prevented spread of the influenza virus.

While it is true that at altitudes higher than 30,000 feet much of the humidity on board an aircraft comes from the bodies and breath of the passengers and crew, the insensible water loss contains no microbes and the breath from persons who are not coughing in response to a pulmonary infection for all practical purposes is sterile.

In summary, the FAA believes that Dr. Dick's testimony based on the study of Moser, et al. is not relevant to the question of humidification of atmosphere on board commercial airliners. It is relevant, however, to the question of health education for the general public. For example, the index case in the study of Moser, et al. should have avoided air transportation while suffering from acute influenza. Secondly, when it became evident that she was acutely ill, she should have been removed from the plane and kept in Homer until her condition became sufficiently will to enable her to fly safely. Airline medical departments have a responsibility to passengers to train their crews to recognize and remove from aircraft persons who are a potential danger to the health of others under such circumstances as arose at Homer.

The source of this information was the article by Moser, et al., in the American Journal of Epidemiology, Volume 11 10; 1-6, 1979.

Question 7. The FAA states that the best remedy against toxic fumes are improvements in cabin materials, improved fire extinguishers and improved smoke removals. We understand that some of the toxic fumes generated in aircraft fires are irreversibly lethal in a matter of seconds or minutes; also that, while there is limited respiratory protection for the cockpit crew, there is none whatsoever for the passengers and none required by law for the cabin crew. We also understand luggage and cargo can generate toxic fumes and the contents of fire extinguishers can be very toxic to humans, especially when used in a confined space like an airline cabin, add to this, that the capacity for smoke removal from the passenger cabin is approximately 3-5 percent of that of the cockpit. Please identify the basis of the FAA decision not to require emergency toxic fume protective breathing equipment for passengers and crew on board an aircraft.

Answer. FAA's current position regarding emergency protection equipment for transport aircraft is to reduce significantly the sources of toxic fumes in a post-crash fire environment in a survivable accident. In this regard, the FAA presently has programs for improving Aircraft Cabin Fire Safety, Passenger Survival and Evacuation, Smoke Evacuation, and Hand-Held Extinguishers for Aircraft Cabins, and the development of a standardized smoke simulator which will simulate the effects of fire and smoke to be used in the testing of airplane cabins. The FAA believes that with improved fire extinguishing equipment (Halon extinguishers) and use of fire blocking material on seats, the toxic fumes potential will be significantly reduced. Standards are already proposed for crewmember protective breathing equipment to counter toxic and irritating atmospheres.

The FAA has not made a final decision concerning the requirement for protective breathing equipment for passengers on board an aircraft. Studies so far have shown that protective breathing equipment for passengers for in-flight fires have questionable merit. One disadvantage is that the donning of such equipment might cause confusion and impede the rapid evacuation of the aircraft. We are still open minded about the merits of future uses of such equipment.

Question 8. Mr. Beard's testimony, it is stated that current FAA regulations for pressurization require that the cabin altitude not exceed 8,000 feet for pressurized

airplanes. Please identify if this regulation is a design or operating regulation. Please give the full and proper citation of the regulations.

Answer. The pertinent regulation is a design regulation. It states in part: "Pressurized cabins and compartments to be occupied must be equipped to provide a cabin pressure altitude of not more than 8,000 feet at the maximum operating altitude of the airplane under normal operating conditions." The full and proper citation of these regulations is 14 CFR 25.841.

Question 8(a). Are pilots allowed to exceed the 8,000 feet cabin altitude pressurization stated above, during the operation of a flight? If so, under what circumstances and what authority?

Answer. Under normal circumstances a pilot is not authorized to takeoff an airplane unless the pressurization equipment is operating in accordance with designed specifications. Under abnormal circumstances such as could occur when a part of the pressurization equipment malfunctions, the regulations authorize a pilot to operate a flight with the cabin altitude in excess of 8,000 feet. However, when operating under these abnormal conditions or at an altitude where an abnormal condition could occur, the regulations require that supplemental oxygen for the sustenance of passengers and crew be carried onboard the aircraft and readily available for use. A pilot operating under these abnormal conditions is required to comply with the approved procedures specified in the air carrier's manual.

Question 8(b). What are the current FAA operating regulations on cabin pressurization?

Answer. There are no FAA operating regulations which pertain directly to cabin pressurization. However, FAA design and operating regulations do specify that supplemental oxygen be carried on board aircraft and, in addition, specify the amount of oxygen that must be carried under various cabin altitude conditions. For your information these regulations are listed is follows: 14 CFR 25.1441, .1443, .1445, .1447, and .1449; 14 CFR 91.32; 14 CFR 121.327, .329, .331, and .333.

Question 9. Has the FAA conducted any cost/benefit studies relating to various pressures and attending health and safety problems? If so, please identify these studies and attach a copy of them to our answers to these interrogatories.

If not, please justify the FAA statement that changing pressurization standards would be exceedingly costly and not cost-beneficial.

Answer. When preparing to testify on May 20 concerning S. 1770, the following information, showing non-beneficial fuel costs for limiting the Boeing 747 fleet to a 5,000 feet cabin altitude, was received from our Transport Airplane Certification Directorate.

Case 1. Strengthening the 747 structure to handle a cabin altitude of 5,000 feet instead of 8,000 feet and to allow continued operation at 45,000 feet would; (a) increase the structure weight by 2,500 pounds, and (b) increase an airplane fuel cost per year based on a utilization of 10 hours per day to a total of $83,300 per airplane per year. For a fleet of 382, the total cost would be $32,000,000 per year.

The "delta p" would increase from 10.92 p.s.i.a. to 12.23 p.s.i.a. at 45,000 feet.

Case 2. Limiting the airplane to a cabin altitude of 5,000 feet rather than 8,000 without strengthening the aircraft structure would: (a) limit the airplane operational altitude to 33,000 feet, and (b) for a New York to London flight, the fuel burned would increase by 7,500 pounds. The cost per flight would increase by $1,375. The fuel cost would increase by $985,500 per airplane per year based on a utilization rate of 10 hours per day. For 382 airplanes it would cost $375,000,000.

The redesign and modification of the Aircraft structure for Case 1 would also be very costly, although we did not quanify that cost at this time.

We have not made benefit studies for requiring cabin altitudes of less than 8,000 feet. However, from a medical viewpoint the vast majority of normal people have no problem with decreased partial pressure of oxygen to as high as 10,000 feet. The partial pressure of oxygen (when breathing air) in the alveoli of the lungs drops from about 10 mmHg to about 60 mmHg on ascent from sea level to 10,000 feet altitude; the blood saturation of oxygen is reduced only by about 8 percent or from 98 percent oxygen saturation at sea the level to about 90 percent saturation at 10,000. Only a small fraction of the population that are not healthy, normal people may benefit with lower cabin altitudes.

Question 10. According to a House report, airline maintenance and ground support personnel are exposed to carbon monoxide, polynuclear aromatics, and chemicals in jet fuel, jet exhaust, cleaning solvents, and paint which are known to cause interalia, neurological damage, cancer, respiratory problems, heart disease, and skin and eye irritation. While this Subcommittee's review is not limited to airline maintenance and ground support personnel, what steps has the FAA taken in response to complaints concerning working conditions by flight attendants?

Answer. With respect to air contamination, and humidification, the FAA has adopted regulations establishing cabin ozone concentration standards. (14 CFR 121.578 and 25.832, effective 2/20/80

Question 10(a). Has the FAA instigated any rulemakings? If so please identify.

Answer. The FAA has instigated and and completed rulemaking on cabin ozone concentration standards (See part I). No other rulemaking actions were instigated on air contamination and humidification (See answers to Question 21).

Question 10(b). Have the airlines taken any measures voluntarily? If so please specify.

Answer. The FAA is generally aware that airlines have on occasion voluntarily taken actions in response to flight attendant complaints and observations. However, the FAA has not compiled records of these voluntary actions and is unable to specify herein.

Question 10(c). Has the FAA compelled the airlines to take precautions concerning these complaints? If so, please identify the action taken and when.

Answer. The FAA has required the airlines to remedy situations resulting in complaints from flight attendants through the regulatory process.

Question 10(d). Is the FAA equipped, both in manpower and expertise to adequately address the issues? Does the FAA monitor airline employee complaints and working conditions?

Answer. The FAA has both the manpower and the expertise to address the complaints of airline employees. The FAA through its inspection, investigation, and surveillance programs, monitors the activities, complaints, and working conditions of the airlines employees when the safety of either the employee or the traveling public may be affected.

Question 10(e). How many flight attendant complaints has the FAA received in the last 10 years? Please furnish a copy of these reports and/or complaints to the subcommittee in your answers to these interrogatories.

Answer. It is not possible to provide an answer to this question. Current record-keeping practices and procedures do not require long-term retention of many of these complaints and consequently it is not possible to furnish a complete set of such complaints. Except for complaints on ozone on which regulatory action has been taken, the FAA field offices receive complaints from cabin crews only occasionally on specific flights. These complaints failed to establish trends and were considered to involve isolated cases.

Question 11. In recent years, the House Subcommittee on Government Activities and Transportation has investigated the relationship between working conditions for employees in the aviation industry and air safety, and the actions taken by the FAA to promote safety and healthful working conditions on the ground. In its previous inquiries into this matter, the House Subcommittee has focused on efforts (or lack thereof) of the FAA to develop and enforce standards addressing working conditions for flight crews. Can you bring this Subcommittee up to date on the steps taken by the FAA to review existing problem areas and promote air safety for both ground maintenance personnel and flight crews?

Answer. The fifteenth report by the Committee on Government Operations (House Report No. 97-393) entitled "Occupational Safety and Health Production for Aviation Industry Employees—the Conflict Between FAA and OSHA" accurately summarizes the work performed by FAA in this area. In recent months, no new information has come to our attention which would cause the agency to reconsider the validity of material presented in that report or in the hearings referenced therein.

Question 12. During these same hearings identified in interrogatory No. 10, a witness from the National Institute of Safety and Health (NIOSH) testified that the major problems in trying to regulate and enforce ground crew health and safety were the jurisdictional problem and the lack of research especially in the health effects of exposure to chemicals. This witness also emphasized that no one from the FAA has ever contacted NIOSH concerning the occupational health and safety aspects of airline carrier maintenance manuals. What, if anything, has the FAA done since these hearings in 1980, and previous House hearings in 1979, concerning the safety issues present at that time?

Answer. Except as it might directly affect flight safety, FAA does not have the statutory authority to regulate the workplace health and safety, nor does it assert such authority. Accordingly, FAA does not have a program to address this issue.

Question 12(a). Are current FAA personnel capable of making medical decisions concerning the health and safety of airline employees? If so, please identify these people and include references to their medical experience and education.

Answer. FAA medical staffing is limited to that necessary to address issues of flight safety, not airline workplace safety. Although our staff physicians are capable

(in the sense that they are medically trained in their respective specialties) of addressing such issues, they are not charged with the airline industry workplace health and safety as part of their normally assigned duties.

Question 12(b). Does the FAA have a policy that requires FAA inspectors to undergo OSHA training in an effort to recognize hazards?

Does the FAA have any procedure or policy to ensure that maintenance manual provisions addressing or affecting the safety and health of airline employees are reviewed either by competent FAA, OSHA or NIOSH personnel to insure that the safety and health of such employees are not compromised by the manual provisions? Please identify these employees. When was this procedure established and why?

Answer. The FAA does not have policy or procedures in this area.

Question 13. According to the House Subcommittee report of the hearings, on August 16, 1980, a witness for the FAA recognized OSHA's expertise in the area of aviation health and safety, however, because of the decision in the Northwest case the FAA has asserted absolute jurisdiction over these areas. As a result, a Memorandum of Understanding was suggested as the only means of correcting the problems without getting into jurisdication fights. Can you tell me whether such Memorandum of Understanding has ever been executed? If not, Why?

Answer. A Memorandum of Understanding has not been excuted. The Administrator of OSHA declined to execute the draft memorandum of Agreement between our two agencies, which had been developed by our respective staffs.

Question 13(a). In the meantime, does the FAA still maintain absolute jurisdiction over these areas?

Answer. FAA does not now, and never has, claimed "absolute jurisdiction" over the airline industry workplace in the area of health and safety.

Question 13(b). And what has the FAA done concerning the health problems mentioned in the hearings of 1980?

Answer. In addition to the information supplied in response to question 12, FAA has met with representatives of NIOSH in regard to airline flight attendant health and safety issues. In mid-1980, after several staff discussions relating to correspondence from the Administrator of OSHA to the FAA Administrator, FAA, OSHA, and NIOSH agreed that NIOSH should undertake a special program in this area. The program was envisioned to cover possible problem areas under two general headings, chemical and physical stressors. Study areas included organic chemicals, jet fuel emissions (hydrocarbons, particulates), fumigation, ozone, CO, CO_2, gamma radiation, vibration platform problems (tendonitis), ergonomics (carts, galleys), reproductive systems, in-flight injuries, and respiratory problems. This program is in the active planning stages at NIOSH.

Question 14. Please identify all studies and investigations that have been conducted by the FAA, it agents or employees or committees authorized in whole or in part by the FAA, concerning the issues raised in S. 1770, and as a result of the hearing on S. 1770 on May 20, 1982. These should include, but not be limited to, all contaminants including smoke (tobacco), ozone, toxic fumes etc.

Please furnish a copy of these reports for our files that are mentioned as part of your response above for the Record

Answer. (a) Report FAA-EE-80-10; Results of FAA Cabin Ozone Monitoring Program in Commercial Aircraft in 1978 and 1979, dated November 1980.

(b). Report FAA-AM-80-9; Effort of Ozone (0.30 Parts per Million, 600 ug/m^3) on Sedentary Men Representative of Airline Passengers and Cockpit Crewmembers, dated March 1980.

(c). Report FAA-AM-80-16; Effect of Long-term Exposure to Low Levels of Ozone: A Review, dated September 1980.

(d). Report FAA-AM-80-20; Effects of Ozone on Exercising and Sedentary Adult Men and Women Repersentative of the Flight Attendant Population, dated October 1979.

(e). Report FAA-AM-66-28; Oxygen in General Aviation, dated September 1966.

(f). Report FAA-AM-77-13; Oxygen Equipment and Rapid Decompression Studies.

(g). Report FAA-AM-79-23; A Description of the Civil Aeromedical Institute Airline Cabin Safety Data Bank: 1970-1976.

(h). Report No. AD736097; Health Aspects of Smoking in Transport Aircraft, dated December 1971.

Copies of the above reports are contained in the attached folder.[1]

Question 15. At this time, is there any subdivision of the FAA that currently collects data concerning the number of inflight, preflight, and post-flight medical inci-

[1]The reports will be retained in the Committee files.

dents that have resulted in fatal or near fatal emergencies? If so, please identify this subdivision for the record. When was this subdivision created?

Answer. The FAA's Accident/Incident Reporting System provides for the collection of reported accidents and incidents investigated and recorded by the FAA. The first subdivision responsible for collecting these reports is the National Safety Data Branch located in Oklahoma City. The next subdivision involved is the Civil Aviation Medical Institute's (CAMI) Protection and Survival Laboratory. This subdivision extracts from the accident and incident reports, information which pertains to medical incidents along with any other information pertaining to cabin safety. The Protection and Survival Laboratory also extracts information from NTSB reports. The collection and analysis of this data is described in further detail in DOT document FAA-AM-79-23 "A Description of the Civil Aeromedical Institute Airline Cabin Safety Date Bank: 1970-1976" which is listed in answer to Question 14.

At present there is no regulatory requirement for the airlines to report all medical incidents. However, any medical incident associated with any event that is required to be reported on through the FAA's Accident/Incident Reporting System is recorded and collected. CAMI's Airline Safety Data Bank was established in July of 1974 and continues to function at present.

Question 15(a). If not, does the FAA know of any private, government or quasigovernment entity that collects the data requested above? Please identify for the record.

Answer. The airlines collect and maintain some data concerning medical incidents. From time-to-time the ATA has collected similar information from member airlines at the request of the FAA or in response to rulemaking proposals.

Question 16. During the hearing on May 20, 1982, Dr. Keshishian stated that he participated in an FAA study as a task force member that involved cabin air quality. He states that the test results were never published because the equipment malfunctioned. Please identify the circumstances of this 1971 study and the issues studied by the ad hoc task force. Also, please state whether the FAA has ever conducted a second study. If so, when?

Answer. A study of the health aspects of smoking in transport aircraft was conducted jointly by the FAA and the National Institute for Occupational Safety and Health, Public Health Service in 1970-71. The purpose of the study was to define the levels of certain combustion by-products of tobacco produced by passengers' smoking; and to obtain passenger opinion on the need for regulation of smoking in commercial passenger airplanes. The study involved (1) the collection of samples to determine the environmental exposure levels to carbon monoxide, particulate matter, polynuclear hydrocarbons, ammonia, and ozone, and (2) the use of a questionnaire during 20 Military Airlift Command international flights and 8 domestic air carrier flights.

The results of environmental samples revealed levels of each contaminant measured that were far below levels recommended in occupational and environmental air quality standards. These combustion by-products were judged not to represent a hazard to the nonsmoking passengers. However, opinion sampling results indicated that over 60 percent of the nonsmokers were annoyed by tobacco smoke and suggested that corrective action be taken such as segregation of the smokers.

The test results were published, and an eighty-five page report of this study may be obtained from the National Technical Information Service, Springfield, Virginia. A copy is attached in response to Question 14.

On one of the 3 flights to Tokyo, Dr. Keshishian, although not a member of the task force, requested and was given permission to ride as an observer.

The FAA has not conducted a second study of smoking in aircraft.

Question 17. Does the FAA view flight attendant complaints as frivolous? Is there any mechanism whereby flight attendant reports and/or complaints are forwarded to the FAA? If not, why? If so, please identify the mechanism.

Answer. The FAA does not view any complaint concerning aviation safety, regardless of its source, as frivolous.

There are many avenues wherein flight attendant complaints are brought to the attention of the FAA. Flight attendants as individuals, collectively, or through their labor organizations may forward any complaint they wish to the FAA. These complaints may be, and on many occasions have been, forwarded to the FAA either by telephone, in writing, or by personal visits to the local FAA district offices, regional offices, or to Washington Headquarters. In addition, FAA inspectors conduct numerous air carrier en route cabin inspections. Approximately 2,000 of these en route inspections are conducted annually. These inspectors listen to flight attendant reports and/or complaints and record their input on their reports. Another mecha-

nism for obtaining flight attendant reports and/or complaints are the cabin safety workshops conducted in Oklahoma specifically directed at airline flight attendant emergency training instructors and union safety representatives. The workshops are intentionally restricted to relatively small groups so that flight attendant problems and complaints can be fully discussed when appropriate.

Question 17(a). At this time who receives the flight attendant reports and/or complaints? Please identify what happens to these complaints subsequently.

Answer. For the most part, flight attendant reports and/or complaints are directed to the local district office having responsibility for surveillance and inspection of the airline involved. Complaints or reports submitted by flight attendant organizations are generally received by FAA Washington Headquarters. All FAA inspector reports on en route cabin inspections are first reviewed and acted upon by the local district office having inspection authority for the airline involved. These reports are further reviewed by FAA Washington Headquarters for any significant systemwide items of interest. The reports are finally sent to CAMI's Protection and Survival Laboratory for further analysis. Problems uncovered during the cabin safety workshops conducted in Oklahoma City are coordinated with Washington Headquarters.

It is the FAA's practice to respond in an appropriate manner to each report and/or complaint submitted by a flight attendant.

Question 18. In his testimony before the Senate Subcommittee on Aviation on May 20, 1982, Mr. Craig Beard stated that the FAA review of the XENEX petition disclosed a ventilation rate that varied from 15 to 25 cubic feet per minute per person in seven transport category aircraft, which equates to about 3 to 5 times the ASHRAE standard for passenger transport aircraft.

We are informed that there are no such ASHRAE standards for passenger transport aircraft and that the standards referred to in Mr. Beard's testimony are standards that have not gone through the consensus process nor been reviewed by the ASHRAE Standard Committee.

Please identify the source of Mr. Beard's testimony and provide a copy of the materials for the Subcommittee.

Further, in stating that 15 to 25 cubic feet per minute per person is adequate, as in Mr. Beard's testimony, does the FAA intend to imply that this is 15 to 25 cfmp fresh air ventilation? If it is part fresh air and recirculated air, please identify the levels of each and whether airlines are required to filter the recirculated air portion. If so, how? If required, please identify the appropriate regulations.

Answer. The source of Mr. Beard's testimony is the ASHRAE 1978 Applications Handbook and Product Directory; the ventilation rate of 2.4 liters/second per passenger on page 9.2 of Chapter 9 equates to 5 cubic feet/minute per passenger which is exceeded 3 to 5 times by passenger transport aircraft. The FAA recognizes that this document is considered ASHRAE guidance information and is not an ASHRAE standard. However, the ventilation rates of passenger transport aircraft compare favorably to the ASHRAE standards of most public places.

The 15 to 25 cfmp was in reference to the total ventilation rate which is the sum of fresh and recirculated air. The following information was received from our Transport Airplane Certification Directorate which shows the fresh, recirculated, and total ventilation rates for most transport airplanes under normal cruise and typical full passenger load conditions; we do not have formal studies or investigation on this matter:

Airplane	Fresh air per passenger	Recirculated air per passenger (c.f.m.)	Total ventilation rate passenger (c.f.m)	Filters efficency (percent)
Boeing Aircraft:				
707	22.0	(1)	22.0	(1)
727-100	23.0	(1)	23.0	(1)
727-200	18.0	(1)	18.0	(1)
737-200	15.0	(1)	15.0	(1)
747	13.1	6.2	19.3	95
757	8.7	8.7	17.4	95
767	10.0	10.0	20.0	95
Douglas Aircraft:				
DC-10	19.0	(1)	19.0	(1)
DC-10 (with recirculation)	19.0	7.4	26.4	95
DC-9-30	20.2	7.4	27.6	(1)
DC-8-60	12.9	7.3	20.2	76
Lockheed L-1011	20.0	(2)	3 20	95

[1] None.
[2] Mixing Venturi recirculating system.
[3] In excess of amount shown.

In the certification of aircraft, the manufacturers propose methods by which they intend to demonstrate the adequacy of their proposed ventilation systems. The ventilation goals that the transport airplane manufacturers have established for their aircraft are approximately 20 cfm of ventilation per passenger, 12–15 air exchanges per hour, and a temperature gradient of approximately 7°F from foot to head. These criteria were established by aircraft operators working with the aircraft manufacturers to attain comfort for passengers. During certification flight tests of the aircraft, flow rates, etc., are measured and compared with the ventilation criterion that the manufacturer has proposed to meet FAA certification requirements.

Question 13. The Subcommittee has been made aware that relatively little information has been accumulated concerning the adverse health and safety effects resulting from direct and indirect exposure to galactic radiation. Please state whether the FAA has conducted any studies or investigations concerning this issue. If so, please identify the beginning and terminating dates of the investigation, the people and parties participating in the study, the conclusions thereof, and if the study was published, the date of that publication and a proper identification of the published document. If not published, the reasons for not publishing the study.

Answer. It should first be pointed out that the FAA does not do research on health effects of radiation. The FAA follows Federal guidelines for health effects established by other agencies and federal advisory groups. These are then used as a basis for policies related to the aircraft environment.

Regarding the first statement in the question, it is not true that there has been relatively little information accumulated concerning the adverse health and safety effects resulting from exposure to galactic radiation. Ever since balloons were flown above 30,000 feet, instruments have measured high altitude radiation for a variety of scientific purposes. Initially, the U.S. Air Force and the Natioinal Aeronautics and Space Administration (NASA) investigated the potential problem related to health effects. The FAA became deeply involved during the mid-1960's with the prospects of civilian air transport employing supersonic aircraft operating at altitudes between 45,000 and 65,000 feet. Studies and investigations conducted by the FAA concerning this issue are listed below. The first two items contain the most important FAA contributions. Numerous additional papers have been published as a result of these investigations both by FAA employees and others. The last three items are efforts continuing to assess the problem in light of the most recent information and technology.

(1) FAA Advisory Committee for Radiation Biology Aspects of the SST: In 1967 thirteen internationally recognized experts were appointed to this committee to analyze available information on cosmic radiation and to institute a substantial program of radiation measurement. The committee ceased operation in 1974 and the results were published in Aviation, Space and Environmental Medicine 46(9): 1170–1185, 1975, "Advisory Committee for Radiation Biology Aspect of the SST: Final Report, Cosmic Radiation Exposure in Supersonic and Subsonic Flight."

Abstract: The main body of this document consists of four major sections: A) An introduction describing the scope of Committee operations and providing a brief exposition of the concepts of radiation protection; B) A survey of experimental and theroretical data on cosmic radiations that have been obtained in individual research projects with emphasis on investigations that were performed under the sponsorship of the Committee. The studies evaluate galactic and solar radiation as a function of altitude and magnetic latitude; C) Best current estimates of cosmic radiation levels in the atmosphere; and D) Radiation protection recommendations dealing with maximum permissible doses and operational aspects covering satellite warning systems, on-board instrumentation, and forecasting. Nine annexes submitted by individual authors cover various of these subjects in greater detail.

(2) FAA Working Group on Cosmic Radiation in Conventional Jet Transport: This working group was appointed by the FAA Advisory Committee for Radiation Biology Aspects of the SST, before it ceased operation in 1974, to study radiation exposures during air travel in the United States in conventional aircraft.

The members of the working group were: Victor P. Bond, M.D., Ph.D. (Chairman), Associate Director, Brookhaven National Laboratory; Hermann J. Schaefer, Ph.D., Naval Aerospace Medical Research Laboratory; Charles A. Sondhaus, Ph.D., College of Medicine, University of California at Irvine; Roger W. Wallace, Ph.D., University of California at Berkeley.

The results of the working group were published by Roger W. Wallace and C. A. Sondhaus in Aviation, Space and Environmental Medicine 49(4): 610-623, 1978, "Cosmic Radiation Exposure in Subsonic Air Transport."

Abstract: This FAA and NASA-sponsored study of cosmic radiation doses received by United States residents flying in commercial jet aircraft is the most extensive to date and combines computer calculations with experimental data. Data derived from 1973 statistics on 2.99 million intercity flights carrying 468 million seats were included in the calculations, yielding a total of 581 billion seat-kilometer.

The average flight was 1,084 km in length, was flown at an altitude of 9 47 km, and lasted 1.41 h. The average dose rate was 0.20 mrem/h, resulting in an average passenger dose of 2.82 mrem/year and an average crew member dose of 160 mrem/year. The average radiation dose to the total U.S. population was 0.47 mrem/person/year. These results are in good agreement with data from several experiments performed by us and others in aircraft at various altitudes and latitudes. The significance of these doses to the population is discussed.

(3) FAA studies supported by the Office of Aviation Medicine at the FAA Civil Aeromedical Institute in Oklahoma City, Oklahoma: These studies were initiated in the 1960's to investigate problems associated with the exposure of aircraft occupants to galactic and solar cosmic radiation. Three FAA reports which have resulted from these studies along with their abstract, are listed as follows: Wallace Friedberg, Ph.D. and John M. Nelson, B.B.A, "Calibration of the Concorde Radiation Detection Instrument and Measurements at SST Altitude," Report No. FAA-AM-71-26, June 1971.)

Abstract: Performance tests were carried out on a solar cosmic radiation detection instrument developed for the Concorde SST. The instrument calibration curve (log dose-rate vs instrument reading) was reasonably linear from 0.004 to 1 rem/hr for both gamma radiation and fast neutrons. Nonlinerity in the calibration curve was observed at dose rates below 0.003 rem/hr. The instrument responded normally after exposure to 30 rem/hr of gamma radiation. The charged particle dectors showed a directional response apparently because of the neutron moderator. The neutron detector did not show a directional response. When accumulated dose—which is shown on the digital display of the instrument—was used to compute the dose rate, the dose rate was overestimated by about 169% at 0.0013 rem/hr and 50 percent at 0.1 rem/hr. Measurements made with the Concorde instrument at 60,000 ft. and high geomagnetic latitudes indicated a galactic cosmic radiation dose rate of 0.7—0.9 millirem/hr. (Wallace Friedberg, Barbara R. Neas, Donald N. Faulkner, Gerald D. Hanneman, and E. B. Dardem, Jr., "Radiobiological Aspects of High Altitude Flight: Relative Biological Effectiveness of Fast Neutrons in Suppressing Immune Capacity to an Infective Agent," Report No. FAA-AM-78-8, February 1978.)

Abstract: We investigated the relative biological effectiveness (RBE) of fast neutrons compared with X-rays in impeding development of immunity to an infective agent, the intestinal cestode Hymenolepis nana. Mice were irradicated with neutrons or X-rays and 2 days later given an immumizing dose of H. nana eggs. After another 2 days, the mice received a challenge dose of the eggs. Challenge egg doses were also given to sham-irradiated unimmunized and immunized controls. All mice were killed 90 to 92 hour after challenge, and the H. nana larvae (cysticercoids) that developed in the intestinal tissue were counted. An increased cysticercoid count in the irradiated mice, as compared with the count in unirradiated immunized controls, reflects suppression of immune capacity by the radiation. The results indicate a neutron RBE of 4 at 50 and 101 rad. (Wallace Friedberg and Barbara R. Neas, Summary of "FAA Advisory Committee on Radiation Aspects of the SST: Cosmic Radiation Exposure During Air Travel," Report No. FAA-AM-80-2, March 1980.)

Abstract: In 1967 the FAA appointed an advisory committee on radiation biology aspects of SST flight. Some of the committee members were subsequently appointed to a working group to study radiation exposure during air travel in conventional jet aircraft. Presented here, in some cases in revised form, is selected material from the final reports of the full committee and the working group and related material from other sources. Included are: (i) brief descript[illegible]s of the galactic and solar cosmic radiation environment; (ii) estimates of accum[illegible]d radiation dose during air travel and associated risks of genetic and somatic effe[illegible]; (iii) altitude, solar cycle, and geomagnetic latitude profiles of galactic radiation; (iv) radiation protection recommendations by the committee; (v) current status of forecasts and monitoring of solar radiation events; and (vi) operational experience related to Concorde flights.

(4) An internal staff review during 1977 by the FAA Office of Environmental Quality to address the potential radiological hazards to air commerce. (William S.

Smith, Jr., "Radiological Hazards to Air Commerce," Report No. FAA-AEQ-78-04, February 1978.)

Abstract: A survey of existing literature concerning radiological hazards to air commerce has been completed. A preliminary assessment of three major sources of potentially significant ionizing radiation has indicated that although some data are lacking, no actual danger to either passengers or cres has been documented. Cosmic radiation from galactic sources represents a relatively well understood and easily predictable phenomenon. Solar flare activity and nuclear testing episodes, however, are infrequent events which require an ongoing effort to maintain a current understanding of health and safety related issues.

(5) Development of a Satellite-Based Aircraft Radiation Monitoring System. NASA Langley Research Center has been developing a real-time radiation warning network based on satellite technology. During 1979 and 1980, the FAA supplemented the NASA work in this area to do laboratory tests for data base evaluation to enable the FAA to translate radiation measurements at satellite altitudes to biological effective radiation at aircraft flight altitudes.

This work was performed under the direction of Dr. John W. Wilson of NASA Langley Research Center. The current status of the radiation warning network, which includes the FAA funded research, has been published by Dr. Wilson in Health Physics Vol. 41, No. 4, pp. 607–617, October 1981.

Abstract: Ground-based and satellite-based ionizing radiation monitoring systems are considered as alternative methods for ensuring safe radiation levels for high-altitude aircraft. It is found that ground-based methods are of limited accuracy due to insensitivity to solar particles of energies between the riometer upper cutoff of about 50MeV and the neutron monitor threshold of about 450 MeV. This energy range is demonstrated to be essential for atmospheric radiation monitoring at high altitude, and must be covered by satellite measurement. On the basis of presently available data, the accuracy to which the incident solar particle flux must be measured by satellite-borne detectors is examined and recommendations are made to establish minimum requirements.

Question 20. According to P. R. Halfpenny, Group Engineer, L–1011 ECS, Lockheed California Company, author of Aircraft Humidification Systems Development:

"Air humidification systems have in the past had operational and maintenance problems that have caused most airlines to consider the concept impractical. However, as flight segment lengths have increased, the adverse physiological effects of low humidity have become more pronounced and consideration has been given to developing systems more compatible with airline operations.

"Relative humidity in the flight station typically is less than 5% and this has been shown to adversely affect crew comfort, performance and health. Similar effects are reported by flight attendants and passengers where cabin humidity is as low as 5–7%."

In view of Mr. Halfpenny's above remarks, please explain and identify for the Subcommittee, the facts and information that form the basis of the FAA's statement that "the humidity level aboard an aircraft is, in essence, a matter of comfort and not a safety or health issue."

Answer. Mr. Halfpenny's comments on the adverse physiological effects and the adverse effects on crew comfort and health are reiteration of statements which have appeared in various articles and text books but which have not been documented by references to carefully conducted studies. Considering the multifactorial input to the elusive quantity of subjective passenger comfort, FAA believes it is unfair to attribute these subjective impressions to low relative humidity when many other factors, particularly those relating to the life style of the complainers, may be more seriously involved. The FAA response to Question 5 provides further information in answer to this question.

Question 21. In a 1952 survey conducted by the A–9 Committee of the SAE, flight crews complained about the discomfort of the dry cabin air, the increased incidence of colds, and the debilitating effects of smoke and odors resulting from recirculation of cabin air into the flight station. As a result of these objections and other developments, regulations have been established that require that the flight station be supplied with 100 percent fresh air through an independent temperature control system. Please cite the regulations that are mentioned above.

Answer. The regulations mentioned above are contained in section 25.831 of the Federal Aviation Regulations (see answer to question 3).

Question 21(a). In view of the above 1952 survey and the regulations subsequently adopted, I find it particularly disturbing that an industry which recognized and accommodated problems reported by one segment of its employees can remain totally ambivalent to identical complaints from other segments of the same industry.

Please explain the FAA's rationale for recognizing that prior complaints have resulted in regulations for cockpit crews while maintaining it is unaware of current problems experienced by cabin crews and passengers in the area of health affects due to cabin air quality.

Answer. From the attached pertinent portions of Amendment 4b–6 of the Civil Air Regulations, it is clear that the fresh air requirements for the flight crew were established to permit them to perform their duties without undue discomfort or fatigue. Effective execution of flight crew duties is critical to the safety of the operation of the aircraft while such consideration does not necessarily apply to passengers and the cabin crew. Furthermore, FAA field offices have only occasionally received complaints from passengers and cabin crew about specific flights. These complaints failed to establish a trend to warrant definitive regulatory action and have been regarded as isolated cases.

The FAA takes regulatory action when appropriate; as an example, complaints received on effects of ozone contamination revealed more than an isolated problem. As a result, FAA adopted new regulations which are contained in 14 CFR 25.832 and 121.578.

Senator KASSEBAUM. Next there is the consumer employee panel.

Senator INOUYE [presiding]. I now have the privilege of assuming the chair.

We now have the consumer employee panel, and we are pleased to welcome Mr. Mathew Finucane, director of the Aviation Consumer Action Project of Washington; Ms. Carmen Azzopardi, director of health and safety, Independent Union of Flight Attendants; Ms. Susan Miller, acting health coordinator, Association of Flight Attendants; and Ms. Achenbaugh, central safety representative.

STATEMENTS OF MATTHEW H. FINUCANE, DIRECTOR, AVIATION CONSUMER ACTION PROJECT; DR. EVE BARGMANN, PUBLIC CITIZEN HEALTH RESEARCH GROUP, CARMEN M. AZZOPARDI, DIRECTOR, HEALTH AND SAFETY, INDEPENDENT UNION OF FLIGHT ATTENDANTS; SUSAN MILLER, ACTING HEALTH COMMITTEE COORDINATOR, ASSOCIATION OF FLIGHT ATTENDANTS; AND NORVA ACHENBAUGH, MASTER SAFETY REPRESENTATIVE, UNITED AIRLINES

Mr. FINUCANE. Thank you.

With me today is Dr. Eve Bargmann from the Public Citizen Health Research Group.

All too often there is a tendency to dismiss the problem of emergency medical kits as a minor one in the vast and highly complex field of aviation safety. In fact, it is one of the most important issues facing FAA today in terms of unnecessary loss of human life. After all, there were no air carrier accidents in 1980 and 1981. Yet, in each of those years an estimated 100 persons died when they were stricken by heart attacks, severe allergic reactions, diabetic comas, seizures, choking, and other in-flight emergencies.

Untreated in-flight emergencies are therefore the leading cause of aviation-related deaths in the United States. Fortunately, there is a solution, placing a simple emergency medical kit aboard aircraft for only about $230 per plane. There is no need for doing complex research before doing this. There is no need for studies. All that is needed is for this subcommittee to set a deadline for the FAA to install these life-saving devices.

Let me elaborate a little bit on the gravity of the situation. Although an estimated three out of four long distance flights have physicians on board, the FAA currently requires airlines to only carry first aid kits that amount to little more than a few bandages

and splints. And as Senator Goldwater points out, the crew often does not even know where this first aid kit is.

This first aid kit derives from a Johnson & Johnson in-flight kit first put together in 1924 that is now on display in the Smithsonian Museum. As you can imagine, the contents of these kits are grossly inadequate to handle the large majority of serious in-flight problems that develop.

Since an emergency landing can take more than an hour, particularly in adverse weather conditions where you have to find an appropriate airport or where you are flying a jumbo jet, the availability of only band-aids and splints in a serious emergency is nothing but a tragedy and a farce.

Over a year ago our group, along with the Health Research Group, filed a petition asking the FAA to require airlines to carry emergency medical kits. We cited several kits that could be used, including a kit put forth in 1976 by the Air Transport Medicine Committee of the Aerospace Medical Association.

Since that petition was filed, 529 persons and groups have written the FAA supporting our proposal. Only six persons opposed it. Of the persons supporting the petition, 275 were doctors and other health professionals. Listen to what some of these doctors told the FAA. One doctor wrote

> A passenger with known diabetes and hypertension suddenly became comatose and cyanotic. The airplane had no stethoscope, no blood pressure cuff, and no emergency medications. Without these tools, I was helpless to diagnose or treat, despite much experience as an emergency physician.

Another doctor wrote:

> I encountered a simple medical situation, but untreatable at 35,000 feet because of the primitive medical conditions aboard U.S. commercial aircraft. A diabetic had taken his morning insulin and did not eat lunch that day. The resulting low blood sugar produced a grand mal seizure. Three physicians, all qualified to treat the emergency, were unable to provide definitive treatment because of the complete absence of any support equipment.

We were not surprised by the strong outpouring of physician support for placing these kits on aircraft. According to one poll, 91.6 percent of physicians report that they will come forward in an emergency to help passengers, and 89 percent said that airlines should be required to carry basic emergency medical kits and medications.

We agree with you, Senator Goldwater, that Good Samaritan legislation should be passed to help these unselfish and caring physicians. However, there is no need to wait for such legislation before requiring kits, since physicians have shown that they are willing to come forward without such legislation, and such legislation could take a considerable amount of time.

One reason for the broad support for emergency medical kits is that their benefits outweigh their costs. If we were to do a cost-benefit analysis in this area, the central question would be. "Is saving a human life worth $230?" Since this is what a typical kit might cost. With an estimated 100 people dying a year in flight, it is hard to argue against the cost effectiveness of placing a $230 kit aboard an aircraft.

Senator Goldwater, Senator Inouye, yesterday, after over a year of waiting for a response from the FAA to our petition, we received

word from the agency that it has no intention of conducting a rulemaking in this area in spite of the overwhelming physician support for our petition.

We think the FAA's announcement, coming a day before this hearing, is an insult to this subcommittee. This subcommittee expressed an interest in this matter, invited the FAA to testify, and the FAA's response is to attempt to foreclose the rulemaking process the day before this hearing. The FAA is saying that it does not care what this subcommittee thinks, and I think that is terrible.

While the timing of the FAA's announcement is an insult to the subcommittee, the reasoning behind their announcement is an insult to all the people who are going to need these kits some day but are going to die while physicians watch helplessly. According to the FAA, it has no jurisdiction in this area. It has no jurisdiction, it says, because it can only legally require equipment to treat illnesses that are caused by flight, such as a broken bone from air turbulence, and not illnesses that occur in flight, such as a diabetic coma or a heart attack.

This distinction, which never occurred to the FAA before yesterday even though it has been studying this area for years, is so contrived, so false and so heartless that it makes a mockery of the entire regulatory process. Everyone knows that the FAA Act gives the FAA tremendously broad jurisdiction over all aviation safety areas, and there is not an area of flight that the FAA does not get involved in.

Everyone knows that the FAA Act does not make distinctions between problems that occur in flight and problems that are caused by flight. The FAA is simply wrong as a matter of law. When we called them yesterday to find out what part of the statute they were relying on in denying any jurisdiction in this area, even they said they did not know which part of the statute it was.

The distinction also does not make any sense medically. It is well known in the medical profession that the air pressure changes, the reduction in oxygen and the stress of flight can contribute to a variety of cardiovascular and pulmonary problems.

I apologize for going over my time, but I would like to conclude by noting that all we are asking for is that Americans get the same protection as passengers on foreign airlines. El Al, SAS, Air France, Alitalia, Iberia, Lufthansa, Sabena, Air Canada, all of these airlines carry these kits or are about to do so. And we see no reason why Members of Congress, the business travelers of America, and those who are traveling for pleasure in the United States should have less protection than those traveling in foreign countries.

Thank you very much.

[The statement follows:]

STATEMENT OF MATTHEW H. FINUCANE, DIRECTOR, AVIATION CONSUMER ACTION PROJECT

Madam Chairman, Members of the Subcommittee: Thank you for this opportunity to appear before you today to discuss the need for emergency medical kits on board commercial aircraft. In our eleven years of working as a non-profit group for greater passenger safety, we have seldom come across a more disturbing issue than the failure of the Federal Aviation Administration to require emergency medical supplies and equipment in aircraft. It is disturbing because unlike other aviation safety

areas where solutions are technically complex and expensive, this is an area where a simple, inexpensive solution costing under $250 per plane could easily save many of the estimated 100 people who die in-flight each year.[1]

Although an estimated three out of four long-distance flights have physician passengers on board,[2] the FAA currently requires airlines to carry only oxygen and first-aid kits that amount to little more than a few bandages and splints.[3] This first-aid kit derives from a Johnson & Johnson in-flight kit put together in 1924 that is on display in the Smithsonian Air and Space Museum. The 1924 kit "is itself based upon 'Johnson's Airplane First-Aid Cabinet' dated 1915."[4] That was 12 years after the Wright Brothers took off at Kitty Hawk. As you can imagine, the contents of the kit are grossly inadequate to handle the large majority of serious medical problems that passengers develop—problems such as heart attacks, heart rhythm abnormalities, rapid blood loss, anaphylactic (severe allergic) reactions, asthmatic attacks, and diabetic coma. Since emergency landings can take more than an hour, particularly in adverse weather conditions or where a jumbo jet must find an appropriate airport, the availability of only oxygen and band-aids in an emergency is both a tragedy and a farce.

On February 10, 1981, ACAP and Public Citizen Health Research Group filed a petition asking the FAA to require airlines to carry emergency medical kits for use by physicians who come forward in an emergency. In our petition, which we will submit for the record, we cited several medical kits that could be used, including a kit suggested in 1976 by the Air Transport Medicine Committee of the Aerospace Medical Association. This kit contains such inexpensive but potentially lifesaving items as: digitalis, atropine sulfate, lidocaine, and nitroglycerin for cardiovascular emergencies; aminophylline for asthma, diazepam, phenobarbital, and dilantin for seizures; insulin for diabetic acidosis; dextrose for insulin reaction; epinephrine for anaphylactic shock; a stethoscope, a blood pressure cuff, and medical instruments necessary to stop life-threatening bleeding and to save victims of choking. (Attachment 2.)

Since that petition was filed, 529 persons and groups have written the FAA supporting our proposal. Two hundred and seventy-five of these are doctors and other health professionals. Their letters describe over 100 serious in-flight illnesses, including five deaths and 17 cardiac emergencies. Many of the illnesses these letters mentioned would have responded dramatically to the inexpensive drugs and equipment we are urging the airlines to carry. Listen to what some of these doctors told the FAA:

"I was once in the position of having to deal with a man who died on a plane I was travelling on. He might not have if there had been proper equipment and supplies." John Lowe, M.D. (Attachment 3.)

"On two occasions while flying on American lines (sic) I was called upon to provide emergency medical aid—on the first—cardio-pulmonary resuscitation for a 65 year old man who had sustained myocardial infarction with cardiac arrest and the other—63 year old man who sustained right hemiplegia . . . In both situations, not even a band-aid was available, absolutely no emergency medical equipment!" Ralph E. Faucett, M.D. (Attachment 4.)

"[I] was led to a 20 year old man who was having an allergic reaction . . . fortunately a passenger was carrying a bee sting kit which included epinephrine . . . Subsequently the cabin attendants asked me to write to the president of Northwest Orient requesting him to consider a medical kit on board each plane. They recited numerous other similar events, where a doctor was present but no supplies were carried." David Schlim, M.D. (Attachment 5.)

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[1] Air Transport Association of America, Letter to Modern Medicine, July 18, 1977 estimating one death per three million passengers. (Airlines enplane about 300 million passengers per year.)

[2] Mohler, S.R., et al. "Idealized inflight airline medical kit: A committee report," Aviat. Space Environ. Med. 47(10): 1094 (1976); Pasquet, J., "Emergency medical kits aboard aircraft," Aviat. Space Environ. Med. 48:882-885 (1977).

[3] The contents of such an "approved first-aid kit" are set forth in Appendix A to Part 121, which states in pertinent part: Adhesive bandage compresses, 1-inch, 16; antispetic swabs, 20; ammonia inhalants, 10; bandage compresses, 4-inch, 8; triangular bandage compresses, 40-inch, 5; burn compound, ⅛ of an ounce or an equivalent of other burn remedy, 6; arm splint, non-inflatable, 1; leg splint, non-inflatable, 1; roller bandage, 4-inch, 4; adhesive tape, 1-inch standard roll, 2; bandage scissors, 1".

[4] Mohler, S.R., "Emergency medicine and the airline passenger," Aviat. Space Environ. Med. 51(9): 918 (Sept. 1980). (Attachment 1.)

Attachments 1 through 9 have been retained in the committee files.

[A] passenger with known diabetes and hypertension suddenly became comatose and cyanotic. The airplane had no stethoscope, no blood pressure cuff, and no emergency medications. Without these tools, I was helpless to diagnose or treat, despite much experience as an emergency physician." Willa H. Drummond, M.D. (Attachment 6.)

"I encountered a simple medical situation, but untreatable at 35,000 feet because of the primitive medical conditions aboard U.S. commercial aircraft. A diabetic had taken his morning insulin and did not eat lunch that day. The resulting low blood sugar produced a grand mal seizure. Three physicians (all qualified to treat the emergency) aboard were unable to provide definitive treatment because of the complete absence of any support equipment . . . I am sure these and other ideas have been presented before. Where is the response?" Michael Diamant, M.D. (Attachment 7.)

"Even in today's anti-regulation environment there are still regulations that make sense and I think this is one of them." Larien G. Bieber, M.D. (Attachment 8.)

In spite of this overwhelming support for the proposal (only six commenters opposed it), the FAA has yet to even issue a notice of proposed rulemaking—the first step in its often interminable rulemaking process. If the Subcommittee agrees that these kits should be on board aircraft, we urge you to give the FAA a deadline, such as six months, for requiring them. While 50 people might die in-flight between now and then, this would still be a remarkably short time for an FAA rulemaking action.[5]

PHYSICIAN SUPPORT FOR EMERGENCY MEDIAL KITS

We were not surprised by the strong outpouring of physician support for placing emergency medical kits aboard aircraft. According to a survey of physicians published in American Medical News (July 25, 1980), 91.6 percent of physicians polled reported that they would come forward to help a passenger who became ill during a flight. 19.8 percent said that they had actually been called upon to provide such help. And 88.9 percent of the physicians said that airlines should be required to carry basic medical equipment and medications aboard aircraft. (Attachment 9.) In a similar survey in the mid-1970s "all responding physicians, except one, stated they felt . . . that additional equipment should be made available." [6]

The fact that over 90 percent of physicians will come forward in an emergency is a particular credit to the medical profession when one considers that these physicians may be exposing themselves to lawsuits. We therefore urge the Subcommittee to assist physicians who are willing to help by considering the need for a Good Samaritan Act that will protect physicians who attempt to save their fellow passengers.[7] But it would be folly to wait for the passage of such a bill before placing emergency medical kits on aircraft since: (1) we have never heard of a physician being sued for care rendered in-flight; (2) the vast majority of physicians are willing to come forward without such legislation; (3) Good Samaritan legislation could take much longer than a simple FAA rule change because several different committees might have jurisdiction; and (4) accurate diagnosis and effective treatment of victims using a modern emergency medical kit is less likely to produce litigation than inaccurate diagnosis and ineffective treatment using a 1924 first-aid kit.

COST-EFFECTIVENESS OF MEDICAL KITS

If we were to do a cost-benefit analysis in this area,[8] the central question would be "is saving a human life worth $230?" Several letters to the FAA suggested as a prototype airline kit the Emergency One Kit, now sold by Banyan International Corporation. This kit contains a variety of medications, needles and syringes, a stethoscope and blood pressure cuff, equipment to maintain an airway, and other medical supplies, all packed in an attaché case. It weighs 11 pounds and costs $229.99. With an estimated 100 people dying a year in-flight, it is hard to argue

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[5] The snail's pace movement of FAA research and rulemaking can be seen in its quarter-century consideration of an airborne collision avoidance system, its 30 year consideration of stronger seat tiedowns, and its 20 year consideration of less flammable cabin materials.

[6] Hays, M.D., "Physicians and airline medical emergencies", Aviat. Space Environ. Med. 48:468 (1977).

[7] Such an Act might also protect airplanes from suits for providing the kits to physicians in the first place.

[8] ACAP looks with disfavor at cost-benefit analysis in the aviation area because Congress told the FAA in the Federal Aviation Act of 1958 to seek "the highest possible degree of air safety", not the degree of safety which the airlines believe they can afford.

against the cost-effectiveness of placing a $230 kit aboard aircraft. And given economics of scale, airlines may well be able to provide a similar kit at even less cost.

Even the fleet-wide installation and replacement costs are trivial compared to the benefits. If airlines purchased one of these kits for each of the 2500 air carriers now in operation, the total initial cost would be under $575,000 industry-wide. Replacing used or expired medications is much less costly—perhaps $50 per kit per year, or $125,000 per year for the entire industry. Averaged over the first ten years of use, the cost would be $170,00 per year for the entire industry.

While we would be the last to put a dollar value on human life, we can for purposes of comparison look at other agencies' estimates of the cost to society of a preventable death. For example, in 1972 the Department of Transportation estimated that the cost to society of an auto fatality is approximately $200,000 in productivity losses (market and nonmarket), insurance administration, losses to other individuals, employer losses, funeral costs, community service losses and other losses.[9] If emergency medical kits saved just one life a year, the $170,000 cost would therefore be more than compensates.

The airlines could also profit directly from installing these kits. There are about 300 unscheduled landings a year due to a life-threatening medical emergencies, and "One diversion of a Boeing 747 can cost thousands of dollars in terms of fuel expenditure, passenger rebookings, hotel bills, airport landing fees, crew replacements, and other related factors, far exceeding the original cost and maintenance of the emergency medical equipment. [Foreign airlines providing emergency medical kits] report that passenger safety and welfare are enhanced and total flight operating costs are decreased." [10]

If only 100 unscheduled landings a year were prevented by installing emergency medical kits, and if these unscheduled landings would have cost only $2,000 each, then the total amount saved would be $200,000—more than the annual cost of the kits. The list of those who would benefit from installing these kits therefore includes not only doctors, stricken passengers, and society, but also airline stockholders.

AMERICA FAR BEHIND OTHER COUNTRIES

Many foreign airlines provide emergency medical kits for use by physicians. These include Air France, Alitalia, Iberia, Lufthansa, and Sabena. Two airlines, Air Afrique and UTA, even have a special medical compartment for long trips that it "used in connection with resuscitation, isolation, and other medical assistance of seriously ill passengers."[11]

A recent issue (April 23-30, 1982) of the AMA News trumpeted Air Canada's decision to install emergency medical kits with the hope of saving "many of the approximately 10 in-flight deaths" on Air Canada yearly. The article, subtitled "Most in-flight deaths preventable" states that the captain has the only key to the storage cabinet, that only physicians who suitably identify themselves can use the kits, and that the kit has a quick-reference guide to assist physicians with questions as to what to do.

We see no reason why Members of Congress, the business travelers of America, and those who are travelling for pleasure in the United States should have less protection than persons travelling on foreign carriers.

In aviation safety, America usually leads the world. We urge this Subcommittee to ensure that the FAA provides U.S. passengers the same degree of safety provided by foreign airlines in foreign countries. The best way to do this is to give the FAA a deadline for completing rulemaking in this area, for the agency's good intentions are only exceeded by its inability to proceed in a timely manner.

Thank you again for this opportunity to appear before you.

Senator INOUYE. Thank you very much.

Senator Goldwater.

Senator GOLDWATER. I appreciate that testimony. When I fly the friendly skies, all I want is a band-aid.

Mr. FINUCANE. It may have been packed in 1924.

Senator INOUYE. I am certain you were here when Dr. Jordan said that the average kit would cost $600. Is that necessary?

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[9] National Highway Traffic Safety Administration, Department of Transportation: "Societal Costs of Motor Vehicle Accidents" (April 1972).

[10] Mohler, S.R., supra n. 4, at 918.

[11] *Id.* at 920.

Mr. FINUCANE. No. Several physicians wrote to the FAA recommending a kit made by the Banning Corp. which would cost $230. It contains all of the medications that you would need for the predictable cardiovascular and pulmonary problems that might arise, and it also contains the equipment that you would need, such as stethoscopes, blood pressure cuffs, and devices to stop bleeding and choking.

Senator INOUYE. Would that kit have been able to assist the patient with the diabetic coma?

Mr. FINUCANE. Yes, it would. It has three or four medications for diabetic problems.

Senator INOUYE. That kit would have assisted all of those that you cited?

Mr. FINUCANE. Yes. And the physicians wrote in complaining that they wanted to treat these patients, they thought that they could help them, and that they were unable to do so because all that was there were band-aids and splints.

I would like to just mention a little more about the cost. If you look at the fleet-wide installation cost, it would be about $170,000 a year over 10 years. And we think that that would be compensated if just one life was saved, because Federal agencies have put the value of human life to society at $200,000.

We also think that the airlines could profit from this. The foreign airlines report that the decreases in emergency landings outweigh the costs of placing these kits on board. So we think the cost-benefit analysis argues for putting these kits on board.

I am sure you heard this morning that the AMA apparently has come out against this for two reasons. One was a potential for misuse of these kits; and another was that they felt that there was a low incidence of these incidents on board.

Yet according to the AMA statement, passenger deaths occur at one person per 6.4 million revenue passengers, which would still work out to 50 deaths per year. And I think it is anomalous that a profession that will spend hundreds of thousands of dollars to save a seriously ill neonate or premature baby cannot see the need for spending $230 to save the life of a 64-year-old businessman who has had a heart attack.

The other reason the AMA gave was that these kits might be misused. But the foreign airlines have all solved this problem by simply saying, in Air Canada's case, that the captain has the only key to the kit, which fits in an attaché case and he is only allowed to give it out to a person who properly identifies himself as a physician. So we do not see any reason not to include these kits.

Senator INOUYE. Is the AMA afraid of their doctors?

Mr. FINUCANE. No, I do not think so. And I really do not think that the AMA in their statement represents the medical community, because 90 percent of physicians in these polls have said that they would come forward regardless of whether there is Good Samaritan legislation, and that they feel that these kits are necessary.

So I do not think the AMA's position really shows the same generosity of spirit and unselfishness that the actual physicians flying are willing to show.

Senator INOUYE. I have a feeling that your doctor friend wants to say something.

Dr. BARGMANN. I just had an impulse to make a comment, as a physician, that the vast majority of illnesses and fatal illnesses that are being reported are eminently treatable. They are easy to treat with medications. If a person has a heart attack and develops abnormal heart rhythms, there are medications for that. If a person has an allergic reaction, there are medications for that. If a person chokes, there is equipment that you can have to maintain an airway.

So you are talking about emergencies that, if somebody gets to them in time, quickly, are definitely treatable, the vast majority of them, with what would be in this $230 kit.

Senator INOUYE. Senator Goldwater?

Senator GOLDWATER. The suggestion that I would make, and I think probably all of you people who fly would agree, that this medical kit would arrive in the cockpit and the key would be in the custody of the captain. Now, our captains of airlines are notorious for not having commonsense. And just like you girls have to make an accounting for every little bottle—I have watched you count them up and swear on a holy oath that everybody drank it.

The captain would be responsible, and I think the captains are responsible people. We also find, though, on board many men who are trained in paramedics and women who are trained in paramedics. We find nurses aboard.

I do not think we are talking about catastrophic happenings. I get back to this case of the doctor friend of mine who found this man with a piece of meat stuck in his throat. I would not hesitate to run something down a man's throat to relieve him if he was going to die, but I would rather have a nice shiny piece of medical equipment than a coat hanger or my dirty finger.

I cannot understand for the life of me why our airlines in this country are so reluctant to provide medical kits. I think it would increase the passengers' interest in flying with them, and I cannot understand the arguments of the FAA as to why they do not have medical kits.

Every single airplane that the U.S. Navy, Air Force, Marines or Army flies has a little brown khaki bag and it is full of medicine. And if you think pilots in those forces know how to use them, you are crazy. So we provide those things for the common runt of a pilot who would have trouble putting a band-aid on his finger.

I do not know why we cannot spend a little money to make the passenger feel well. There is always something up there in that cockpit that can help me. I get airsick. You do not have a pill for that. You get a headache. You do not have a pill for that. Those things will not kill you.

I have ridden too many times on airplanes, and I challenge the FAA to go up and find these medical kits. I do not think many of you girls can find them.

Mr. FINUCANE. Senator Goldwater, I would like to add that we cannot understand the FAA's reluctance, especially when you consider that this is the major cause of aviation-related loss of life now. There are very few airline accidents and this is where some action ought to be taken.

I do not think there is going to be any action, though, unless this subcommittee pursues this matter, because as of yesterday the FAA more or less cavalierly said, in a one-page letter, that they do not have any jurisdiction in this area. And I would like to know who does have jurisdiction if they do not.

Senator GOLDWATER. We do.

Senator INOUYE. Thank you very much, Mr. Finucane.

Ms. Azzopardi.

Ms. AZZOPARDI. Thank you. I am Carmen Azzopardi, director of health and safety for the Independent Union of Flight Attendants. On behalf of our 6,000 members, I wish to thank you for the opportunity to comment in support of S. 1770, which directs the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and Federal Aviation Administration rules and regulations.

Along with my written testimony, which I request to be made a part of the record, I wish to further express my concern for the need for an independent study. I have testified before congressional committee previously pleading for research in the area of health problems experienced by flight attendants. However, due to jurisdictional disputes, et cetera, little has been accomplished.

I wish to make reference to congressional hearings held on August 16, 1980 before the Subcommittee of the Committee on Government Operations entitled "FAA-OSHA Jurisdiction over Workplace Safety in the Aviation Industry." The documentation contained in that congressional record is replete with letters regarding the FAA jurisdiction, or lack thereof, over the health and safety of passengers and flight attendants.

I quote from a letter to Mr. Richard Wagner written by Mr. R. L. Kayi of the FAA in December 1979. Mr. Kayi was Acting Chief, Air Transportation Division, Office of Flight Operations. I quote—

> Mr. Robinson's reply to you is correct in that the Federal Aviation Administration does not have the statutory responsibility to monitor or regulate the health status of any person traveling by air into or within the United States.

The FAA frequently denies that any problems exist, be they health or safety related, but by their own admission—and again I quote—

> The FAA has not established any specific method of reporting flight attendants' health impairments. Health problems or impairments along with injuries sustained on the job should be reported to the respective employer.

Incidentally, this is still the case today.

This quote is taken from a letter to Mr. Richard Wagner from C. A. McKay, FAA Chief, Air Carrier Division, Flight Standard Services, April 25, 1978. I made numerous attempts to obtain attention to the ozone problems onboard our aircraft. The FAA denied any responsibility initially. OSHA stated that they had no jurisdiction and referred me back to the FAA. The solution came through the assistance of Dr. Duane Reed, medical epidemiologists with the California State Department of Health Services. Dr. Reed requested epidemic aid from the Center for Disease Control in order to do a study on ozone-related health problems of flight attendants.

The FAA eventually issued an ozone standard for American carriers. This is the only occupational health standard which exists

onboard our aircraft today. Yet, without provisions for monitoring, it is anybody's guess whether or not these standards are being met.

Mr. Jonathon Howe, FAA Deputy Director, Northwest Region stated in the August 1980 hearings, "Because of the FAA's air safety mission and the pervasive regulatory scheme we have in place concerning aircraft design and operations, we have asserted full jurisdiction over health and safety requirements of aircraft in flight."

These comments as well as others in previous hearings have had little effect. Little has changed to prove to us that the FAA has truly accepted that responsibility.

In closing, I wish to say that I am optimistic that the suggested study will show the exact nature and extent of the health problems being experienced. On behalf of the Independent Union of Flight Attendants, I recommend passage of S. 1770, and its request that an independent study and monitoring be implemented in the interest of the safety and wellbeing of the traveling public, as well as crew members onboard American carriers. Thank you.

[The statement follows:]

STATEMENT OF CARMEN M. AZZOPARDI, DIRECTOR, HEALTH AND SAFETY, INDEPENDENT UNION OF FLIGHT ATTENDANTS

I am Carmen M. Azzopardi, the Director of Health and Safety for the Independent Union of Flight Attendants (IUFA). I speak today in support of Senate Bill 1770 which authorizes the Department of Transportation to conduct a study of the adequacy of Federal Aviation Administration standards and industry practices with regard to aircraft cabin conditions.

When I was contacted concerning the possibility of this study, my first reaction was a pessimistic one based upon my prior experiences with the Federal Aviation Administration. Prior congressional committees and sub-committees have considered various aspects of the environment in which crew members work and passengers travel aboard today's commercial aircraft. Yet, in spite of these prior evaluations, many of the conditions continue to exist. Recent newspaper articles have prompted speculation about the safety of or dangers inherent in the cabins of modern jet aircraft. Perhaps these recently-voiced concerns have prompted this bill and perhaps this bill and the suggested study will result in an added measure of safety and comfort for the traveling public as well as crew members. If so, I join in support of the legislation.

As mentioned, I have appeared before or contributed testimony to three congressional subcommittees investigating the aircraft cabin environment. These included:

(1) *Adverse Health Effects of Inflight Exposure to Atmospheric Ozone.*—Hearing before the Subcommittee on Oversight and Investigations of the Committee on Interstate and Foreign Commerce, House of Representatives, July 18, 1979;

(2) *FAA-Aviation Safety Issues.*—Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, August 13 and 14, 1979;

(3) *FAA-OSHA Jurisdiction Over Workplace Safety in the Aviation Industry.*—Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, August 16, 1980.

As a result of the first two hearings, the Federal Aviation Administration promulgated a standards for ozone in aircraft cabins. The permitted ozone level standards of .1 ppm time weighted average and .25 ppm threshold limit value were set and were in keeping with the existing OSHA standards for ozone exposure. However, the airlines were free to choose their own methods to meet these designated standards. These methods included:

(1) predicting the location of ozone concentrations and flying around it;

(2) restricting aircraft altitude in order to avoid the tropopause;

(3) installing ozone filtration devices.

Considering these three methods, it immediately became apparent that the first method of locating and predicting ozone concentrations was a virtual impossibility. Further, restricting aircraft altitude in order to avoid the location of maximum ozone concentration was an economically difficult proposition. In these times of increasing aviation fuel costs, airlines could scarely afford the luxury of flying at

below optimum altitudes or flying around ozone concentrations even if they were capable of easily locating them. Consequently, the third alternative of installing ozone filtration devices have proven to be the only feasible method to meet the designated standards.

There has been a considerable amount of discussion regarding the level of these ozone standards and whether these ozone levels pose a realistic threat to health. Attached as Exhibit 1[1] to the transcript of my remarks is a study prepared by the Civil Aeromedical Institute of the Federal Aviation Administration in October 1979. This study entitled "Effects of Ozone on Exercising and Sedentary Adult Men and Women Representative of the Flight Attendant Population" was somewhat less than conclusive. However, Dr. Melton, the study's author, concluded that, "All exercising subjects showed some effects of 0.30 ppmv . . . ozone . . ., which means that the threshold for ozone effects lies at some level between 0.30 and 0.20 ppmv." See Exhibit 1 to transcript page 92, Section VII, "Discussions and Conclusions." As noted in that 1979 report, the empirical findings conform fairly closely to findings previously reported in the scientific literature and complaints by flight attendants.

Nevertheless, there are presently no provisions made for monitoring ozone levels within the aircraft cabin. Although the standards have been set, there is no way of checking to see if the airlines are flying within these established passenger and crew members safety levels. In fact, the FAA has provided a Notice of Proposed Rule Making (NPRM) which inquires into the possibility of waivers, of the ozone rule aboard certain aircraft. This Notice of Proposed Rule Making is attached as Exhibit 2 to the transcript of these remarks and originally appeared in the Federal Register, Volume 46, No. 225, on Monday, November 23, 1981. The Notice responded to a Petition of Rule Making from the Air Transport Association of America ATA) which proposed an exclusion for cargo aircraft and certain narrow-bodied jet aircraft. The Notice proposed to relieve operators of those aircraft from the responsibility of maintaining ozone control equipment. As noted in our response to the FAA's invitation to comments, the existing rules do not sufficiently protect passengers and crew and thus we cannot agree with any proposal which excludes certain aircraft from the ozone limitation. As I observed in January 15, 1982 correspondence to the FAA, monitoring equipment is absolutely essential in *all* aircraft in order to guarantee compliance of the ozone standards and if exposure to occupants (even if only pilots in cargo category aircraft) is to be kept to safe levels. See Exhibit 3, Azzopardi letter to FAA, January 15, 1982.

My preceeding comments with regard to the FAA's approach to the ozone problem should not be construed to suggest that ozone remains the major danger in aircraft cabin environments. However, I do believe that the FAA has been less than responsive to a real problem. Although ozone standards have now been established, we have no way of knowing whether cabin levels of ozone are in keeping with these established standards.

The airlines are today facing very real economic pressures. Although aviation fuel prices have declined slightly in recent months, the overall levels are considerably higher than those experienced several years ago. When these costs are placed within the context of the economic condition of the air traveling public, it is easy to understand that the airlines have been forced to undertake cost cutting measures. These measures have included flying at higher altitudes, carrying lesser quantities of reserve fuel, and shutting down one of three existing air conditioning packs on wide-bodied aircraft. By shutting down a single air conditioning packs on these wide-bodied aircraft, it is estimated that an airline can save one to three percent on fuel costs. As an unfortunate concomitant of this economy move, one finds that certain areas of the aircraft are often filled with smoke resulting in a blue haze at the flight attendant's working level, above the passenger seats. At least one airline advises its flight attendants to request the pilots to turn on the third air conditioning pack when conditions become uncomfortable. However, the aircraft cabin environment has already diminished to an unhealthy state at that point. Further, in many cases, the fuel for the flight has been calculated with this one to three percent fuel efficiency included and therefore if the third airpack is utilized, a refueling stop might have to be scheduled.

Earlier in my remarks, I mentioned an August 16, 1980 hearing before a House Subcommittee considering FAA-OSHA jurisdiction in the aviation industry. After that hearing, the National Institute for Occupational Safety and Health (NIOSH) was mandated to research these flight attendant health problems. Since that date, the doctors at NIOSH have met with the medical directors of various airlines and have provided a survey of the health of flight attendants at one airline. A copy of

[1] The exhibits referred to in this statement have been retained in the committee files.

this March 1982 health survey is attached as Exhibit 4. As noted in that survey, significant differences were observed between the pulmonary function tests of adult flight attendants flying from New York and Miami as compared with the normal adult population in the State of Michigan. The NIOSH study suggests the need for further testing of pulmonary function abnormalities among flight attendants, the work group classification most exposed to the aircraft cabin environment. (See NIOSH Interim Report No. 1. Flight Attendant Health Survey, March 1982, Exhibit 4 attached.)

As I have stressed before in these remarks, the FAA has proceeded on a somewhat less than expedited basis in assessing industry standards and practices from a health and safety standpoint. While hearings have been conducted, 21 months have now lapsed since the National Institute of Occupational Safety and Health received its mandate to evaluate occupational health problems of flight attendants. Attached as Exhibit 5 to these remarks is a letter recently received from the doctor responsible for the NIOSH evaluation of flight attendant health problems. In that correspondence, he suggests that there are a variety of reasons for the delay in research while admitting in companion correspondence to the FAA that NIOSH has "some concern about chronic changes in pulmonary functions in flight attendants." (See Exhibit 5, NIOSH letters of March 29, 1982).

In conclusion, let me summarize by suggesting that there is presently no FAA-mandated system for reporting flight attendant illnesses and injuries. Consequently, it is not difficult to comprehend the FAA's inability to determine the extent of problems in the work environment and fashion solutions for these problems. As an example, I have cited the promulgation of an ozone standard and the continuing suggestion that monitoring is not necessary to enforce adherence to that standard. Further, although these matters have been raised in prior congressional hearings and aircraft cabin environment problems have been shown to exist, the remedies for these problems are very slow in coming.

In closing, I suggest that while I was pessimistic upon hearing about another study of the aircraft cabin environment where I work, I am optimistic that the suggested study will show the exact nature and extent of the problem and I am glad to see that there is renewed concern over the possibility of environmental contaminants in aircraft cabins. For these reasons, on behalf of the Independent Union of Flight Attendants, I recommend passage of Senate Bill 1770 and its request that an independent study and monitoring be implemented in the interest of the safety and well being of the traveling public as well as crew members aboard American carriers.

Senator INOUYE. Thank you very much. I would just like to make one comment. If the FAA is reluctant to make this study, I am just about ready to amend this bill to ask the FTC to do it. The Federal Trade Commission is really looking for work now. They have been denied work on physicians, lawyers, optometrists, car dealers, et cetera, and I am certain they would love to dig in on the airlines.

Senator Goldwater, don't you think that is a good idea; to let the FTC loose on this one?

Senator GOLDWATER. Well, I do not like the Federal Government fooling around anyplace, but if they are going to have to do it, they are going to have to do it.

Have you ever known or noticed—are any of you—on transcontinental nonstops——

Ms. AZZOPARDI. Yes?

Senator GOLDWATER. Are any of you on transocean flights?

Ms. AZZOPARDI. Yes, sir.

Senator GOLDWATER. Have you ever noticed any physical effects through the lack of humidity after a long flight? Do you become irritated easily? Now, that is not a fair question for a woman. You are born with that.

Ms. AZZOPARDI. Well, we cannot specifically state that it is a lack of humidity that is causing our problems. We certainly do have problems, and it is not just the flight attendants. We do hear passenger complaints as well.

Senator GOLDWATER. You know, even pressurizing a cabin to 8,000 feet, my wife has to carry an extra oxygen bottle because she cannot breathe above 5,000 feet.

Ms. AZZOPARDI. Well, consider the fact that as a passenger, you are breathing a lot less air than a flight attendant functioning as a hostess or working the flight. We are taking a lot more air in, so we are more susceptible to the problems.

Also, you will find that if there is a lot of smoke in the cabin, it has a tendency to rise right to our work level, so that quite frequently we are talking about a blue haze that we are walking through, as we are trying to serve our passengers.

Senator GOLDWATER. I am in favor of doing away with all smoking on aircraft.

Ms. AZZOPARDI. I think we would like that, too.

Senator GOLDWATER. That is all I have.

Senator INOUYE. Thank you very much.

Our next witness is Ms. Susan Miller of the Association of Flight Attendants.

Ms. MILLER. Senator Inouye, Senator Goldwater, I am Susan Miller, acting health committee coordinator for the Association of Flight Attendants. With me today is Norva Achenbaugh, master safety representative, United Airlines.

Our union, representing 23,000 flight attendants from 16 U.S. air carriers is constantly striving to improve cabin safety for all aircraft occupants. Our members have become very concerned about the quality of air available on our airplanes, and the physical problems which have been encountered while working.

There has been an increased amount of information published over the years regarding air pollution in homes, factories, and office buildings. Because of this information, studies have been done and measures have been taken to protect workers at home and in their work environment.

A great deal of information has also been generated concerning the quality of air found within the aircraft cabin, but to date, few standards have been set. The Civil Aeronautics Board, the Federal Aviation Administration, and the Occupational Safety and Health Administration have not recently promulgated regulations governing air quality aboard airplanes with the one exception of addressing ozone levels.

I have 297 reports from 1977 to the present, submitted by flight attendants regarding poor air quality on various aircraft. These reports indicate that physical discomfort and breathing problems have occurred, affecting both themselves and their passengers.

In compiling these reports, I have coded the symptoms as a space-saving measure. The code sheet is found at the beginning of the reports in exhibit A.[1] Under the incident column, I have specified the incident causing the symptoms as perceived by the flight attendant, not necessarily the actual cause. Headaches, dizziness, nausea, chest pain, shortness of breath, fatigue, light headedness, and eye irritation are the predominant symptoms reported.

We have been sufficiently concerned about the seriousness of these symptoms to meet with the Occupational Health and Envi-

[1] Exhibit A has been retained in

ronmental Sciences Department at the University of Texas Public Health and Health Science Center in Houston. They were kind enough to review all of our information and suggest a wide variety of toxic contaminants which could be responsible for the symptoms sustained by our flight attendants. Ozone has already been addressed. Carbon monoxide, carbon dioxide, oxides of nitrogen, nicotine, tar and various other particulate matter, either singly or in various combinations, have also been suggested as possibly contributing to the discomfort.

The Association of Flight Attendants does not wish to imply that we know the causes of the discomfort, nor the long-term health effects to passengers and flight attendants. We do, however, support any studies that may be generated by this forum to investigate the matter.

The University of Texas suggests, and we concur, that a third party, independent of the unions and the airline industry, should conduct an extensive air sampling program aboard commercial flights to determine exactly what environmental pollutants may present a hazard and at what levels those pollutants become debilitating or dangerous.

The university also suggests that a nationwide survey be sent to flight attendants employed by U.S. air carriers in conjunction with the air sampling program. This survey would elicit specific information which would be statistically measurable rather than the random flight attendant reports I have presented.

Perceiving the air carriers as being unresponsive to their concerns, a number of flight attendants have sought private medical assistance for treatment of their disabilities. Physicians for the flight attendants concur that the health problems appear to be work related. Elevated carboxyhemoglobin levels, lung nodules with a high carbon content, and repeated instances of reduced pulmonary function are some of the more serious examples of medical problems encountered. To date, the carriers involved have not admitted that these illnesses may be work related or the result of occupational exposure.

Several flight attendants have kept personal logs concerning their physical symptoms and have attributed these symptoms to the number of air pacs in operation. The air pac was designed in part to ventilate the airplane. An aircraft could be operated without all of its pacs functioning. Fuel savings have been reported to range between 1 and 3 percent when air pacs are shut down. As of October 1981, the Civil Aeronautics Board reduced restrictions on the air pac operation. The CAB regulation, which was eliminated, previously restricted smoking aboard the airplane whenever the ventilation system was not fully operative.

We do not intend to lead you to believe that a solution to the air pac controversy is the final solution to the ventilation problem. Over half of the flight attendant reports do not suggest that air pac operation had any bearing on their symptoms. However, we do suggest that it appears to be a contributing factor.

One flight attendant report refers to passengers sitting with pillowcases over their heads in an attempt to filter the air because of their extreme discomfort. Certainly, increase airflow and a more frequent exchange of air would help alleviate these problems.

The Association of Flight Attendants feels strongly that research into air quality aboard the airplane needs to be conducted. To date, we know of only one airline that is doing sampling aboard their aircraft in response to passenger and flight attendant complaints. With deregulation of the airline industry and the higher density of passenger seating that we are experiencing, cabin air quality can only deteriorate if some reasonable limit concerning environmental pollutants is not established and some method developed to monitor those limits.

On behalf of the Association of Flight Attendants, its members and the traveling public, we would like to thank you for giving us this opportunity to be here today and to share this information we have compiled in support of S. 1770.

[The statement follows:]

STATEMENT OF SUSAN MILLER, ACTING HEALTH COMMITTEE COORDINATOR, ASSOCIATION OF FLIGHT ATTENDANTS

Good morning, Mr. Chairman and members of the Subcommittee. I am Susan Miller, Acting Health Committee Coordinator of the Association of Flight Attendants. With me today is Norva Achenbaugh, Master Executive Council Safety Chairperson, United Airlines, to assist in answering your questions. Our Union, representing 23,000 flight attendants from 16 U.S. air carriers, is constantly striving to improve cabin safety for all aircraft occupants. Our members have become very concerned about the quality of air available on our airplanes and the physical problems which have been encountered while working.

There has been an increased amount of information published over the years regarding air pollution in homes, factories, and office buildings. Because of this information, studies have been done, and measures have been taken to protect workers at home and in their work environment. A great deal of information has also been generated concerning the quality of air found within the aircraft cabin, but to date, few standards have been set. The Civil Aeronautics Board, the Federal Aviation Administration, and the Occupational Safety and Health Administration have not recently promulgated regulations governing air quality aboard airplanes with the one exception of addressing ozone levels.

I have two hundred ninety-seven (297) reports, from 1977 to the present, submitted by flight attendents regarding poor air quality on various aircraft. The reports indicate that physical discomfort and breathing problems have occurred, affecting both themselves and their passengers. These reports can be found in the Association of Flight Attendant files and represent only a portion of the reports written by flight attendants. Not all carriers release these reports to the Union. Many times flight attendants do not write problems up, instead they verbalize the complaint to their supervisors and flying partners. The Association must rely on flight attendants voluntarily sending reports to us for our documentation. The attendants that have submitted reports do so out of frustration prompted by a long history of combatting a particular problem.

In compiling these reports, I have coded the symptoms as a space saving measure. The code sheet is found at the beginning of the report in Exhibit A. Under the incident column, I have specified the incident causing the symptoms as perceived by the flight attendant—not necessarily the actual cause. Headaches, dizziness, nausea, chest pain, shortness of breath, fatigue, lightheadedness, and eye irritation are the predominant symptoms reported.

We have been sufficiently concerned about the seriousness of these symptoms to meet with the Occupational Health and Environmental Sciences Department at the University of Texas, Public Health and Health Science Center in Houston. Dr. Michael Smolensky, Associate Professor of Environmental Physiology, Dr. Bud Fairchild, Toxicologist, Dr. Tom Stock, Assistant Professor of Environmental Sciences, and Steve Flanigan, Industrial Hygenist, were kind enough to review all of our information and suggest a wide variety of toxic contaminants which could be responsible for the symptoms sustained by our flight attendants. Ozone has already been linked as a probable cause for some of these symptoms. Carbon monoxide, carbon dioxide, oxides of nitrogen, nicotine, tar and various other particulate matter, either singly or in various combinations, have also been suggested as possible contributing to the discomfort.

The Association of Flight Attendants does not wish to imply that we know the causes of the discomfort or the long term effects to passengers and flight attendants. We do, however, support any studies that may be generated by this forum to investigate the matter. The University of Texas suggests, and we concur, that a third party, independent of the unions and the airline industry, should conduct an extensive air sampling program aboard commercial flights to determine exactly what environmental pollutants may present a hazard, and at what levels those pollutants become debilitating or dangerous. The University also suggests a nation wide survey be sent to flight attendants employed by U.S. Carriers in conjunction with the air sampling program. This survey would elicit specific information which would be statistically measurable rather than the random flight attendant reports I have presented.

Perceiving the air carriers as being unresponsive to their concerns, a number of flight attendants have sought private medical assistance for treatment of their disabilities. Physicians for the flight attendants concur that the health problems appear to be work related. Elevated carboxyhemoglobin levels, lung nodules with a high carbon content, and repeated instances of reduced pulmonary function are some of the more serious examples of medical problems encountered. To date, the carriers involved have not admitted that these illnesses may be work related and the result of occupational exposure.

Several flight attendants have kept personal logs concerning their physical symptoms and have attributed these symptoms to the number of air pacs in operation. An air pac is designed, in part, to ventilate the airplane. Air pacs operate on air bled from the engine, consequently if an air pac is shut down, the engines require less fuel because all of the energy being generated is used to maintain engine thrust. Conversely, operating an air pac results in an increased fresh air flow which in turn leads to a proportional decrease in fuel efficiency. Fuel savings have been reported to range between 1 percent and 3 percent when the air pacs are shut down. As of October, 1981, the Civil Aeronautics Board reduced restrictions on air pac operations. Since this date, an aircraft could be operated without all of its pacs functioning. The CAB regulation which was eliminated previously restricted smoking aboard the airplane whenever the ventilation system was not functioning. A ventilation system was considered fully functioning only when all parts were in order and operating at the capacity designated for normal service.

We don't intend to lead you to believe that a solution to the air pac controversy is the solution to the ventilation problem. Over half of the flight attendant reports do not suggest that the air pac operation had any bearing on their symptoms, however, we do suggest that it appears to be a contributing factor.

One flight attendant report refers to passengers sitting with pillow cases over their heads in an attempt to filter the air because of their extreme discomfort. Certainly, increased air flow and a more frequent exchange of air would help alleviate these problems.

The Association of Flight Attendants feels strongly that research into air quality aboard the airplane needs to be conducted. To date we know of only one airline that is doing sampling aboard their aircraft (albeit in a less than scientific manner) in response to passenger and flight attendant complaints. With deregulation of the airline industry and the higher density of passenger seating that we are experiencing, cabin air quality can only deteriorate if some reasonable limit concerning environmental pollutants is not established and some method developed to monitor those limits.

On behalf of the Association of Flight Attendants, its members, and the traveling public, we would like to thank you for giving us this opportunity to be here today and share this information we have compiled in support of S. 1770.

Senator INOUYE. Now, after all of this flying, all this time I have spent in the air, I was not aware that they turn off the air conditioning system, the air pacs. Who has authority to turn them on and off? The airlines or the captain?

Ms. AZZOPARDI. The pilots are given instructions to turn off one air conditioning pac, and this is supposed to conserve anywhere between 1 to 3 percent fuel. Now, we think that this is important, certainly especially at the cost of fuel today, and on light loads I do not believe that this is necessarily a problem.

However, we find the same thing happening on full loads where there is an awful lot of smoking, and it does become a problem.

This is where my particular union gets the largest number of complaints. I discussed the blue haze in the cabin from the smoking, and that is basically, we feel, the reason this is not—that there is any less air in the cabin. At least, that is not supposed to occur.

However, there is less air circulation. I should say it does not circulate as frequently with only two pacs instead of three.

Senator INOUYE. So with these air pacs turned off, the circulation of air is slowed down?

Ms. AZZOPARDI. To my understanding, yes, sir, it is. I believe that with three pacs, the air is supposed to turn over approximately every 3 minutes, and it is extended to more like every 5 minutes. And also, something like 20 percent of the air is recirculated each time, so we are talking about recirculated air.

Senator INOUYE. It is like following a bus.

Ms. AZZOPARDI. Unfortunately, yes.

Senator INOUYE. Thank you very much. Ms. Achenbaugh, do you care to add anything to this?

Ms. ACHENBAUGH. The Association of Flight Attendants did not know until just a few days ago that we would be discussing first aid kits. We do have some documentation here to submit to the committee. We will not be going over it but we will submit it to the committee.

Senator INOUYE. Thank you very much.

Well, ladies and gentlemen, I thank you very much on behalf of the committee. Senator Goldwater just left because that one white light indicates that there is a vote going on. When he gets back, I will go to vote. So he was not walking out of here; he wanted to stay, but duty calls. Thank you very much.

Our next panel is the industry panel, Mr. J. P. Reese, director, airworthiness programs, Aerospace Industries Association of America; Mr. Don Collier, director, environmental offices, Air Transport Association; and Mr. Bertil Werjefelt, president of the Xenex Corp. of Honolulu.

Mr. Reese, welcome, sir.

STATEMENT OF JOHN REESE, DIRECTOR, AIRWORTHINESS PROGRAMS, AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

Mr. REESE. Senator Inouye, I am John Reese, director of air worthiness programs of the Aerospace Industries Association, representing the Nation's manufacturers of aircraft, aircraft engines, related components, and equipment, contributing to a safe and efficient air transportation system.

The AIA has reviewed S. 1770 and H.R. 5983 which direct the Secretary of Transportation to conduct an independent study to determine the adequacy of certain industry practices and Federal Aviation Administration rules and regulations.

The AIA maintains that as S. 1770 addresses regulatory issues already being handled by the appropriate Government agency, the FAA, legislation is not required. Industry practices and standards and FAA rules, regulations, and standards are nondiscriminatory and in conformance and parity with non- aviation standards, practices, and regulations.

Industry practices and standards in certain areas surpass nonaviation standards, practices, and regulations. Industry practices and standards are continuously improved. The proposed study is unnecessary and would not be a judicious expenditure of taxpayers' money.

I will now address the six specific areas identified in the bill. Aircraft ventilation rates are equal to or exceed nonaviation environmental standards and would, for example, exceed the rates typical for a meeting room such as this. The number of air changes per unit time is often higher than that provided in nonaviation environments.

Fresh air rates compare favorably with the American Society of Heating, Refrigeration, and Air Conditioning Engineers requirements. The traveling public would have to pay a high price for increased fresh air rates. For example, increasing the fresh air rate to 50 cubic feet per minute per passenger, a number used in a recent petition submitted to and rejected by the FAA, would cost in excess of $633 million for the 727 fleet, and $1.3 billion for the 747 fleet, annually. This is only the cost of the additional fuel cost, to which must be added the manufacturer's cost for new equipment.

Air quality on board airplanes is equal to or better than the ambient, outside, air quality. The ambient air is compressed, resulting in high temperatures on the order of 300 to 600 degrees Fahrenheit, which destroy bacteria present in the ambient air and essentially sterilize the cabin air. Air filters are commonly used to remove particulates.

Humidity levels in aircraft cabins are lowest during high altitude cruise, reaching levels typically 15 to 20 percent relative humidity on short flights, and 10 to 15 percent on long flights. These levels are lower than values which most people would consider optimum for comfort, which are in the range of 35 to 50 percent. However, they are comparable to levels occurring during the winter months in many parts of the world.

For example, ambient air at 20° F., even if saturated with water vapor, gives a relative humidity of less than 15 percent at 70° F. The quality of humidity is no different than that in many nonaviation environments.

Federal aviation requirements, FAR part 25, stipulate that crew and passenger compartment air be free from hazardous concentrations of gases or vapors. The FAR requirement is equivalent to ASHRAE standard 62-73 for the commercial industry; thus, air contamination on airplanes is equal to or less than that in many nonaviation environments.

A sample of cabin air taken from an airplane at National or Dulles, or from an airplane flying over this city would have lower contaminants than the sample taken from this room.

There has been considerable effort over the past 15 years devoted to research and development of masks and hoods which would be donned in the event of a situation where the passengers' oxygen masks are inadequate. For example, crash egress, smoke masks, and hoods were evaluated in 1968 as a part of the AIA crash worthiness program. It is essential that such devices be tested in an environment simulating actual emergency conditions so that both the advantages and disadvantages can be realistically assessed.

In the AIA program, it was determined that the disadvantages, mainly in terms of decreased visibility and evacuation rate, 30 to 50 percent lower, outweighed the advantages. Any future developments in this area must undergo similar rigorous evaluation prior to incorporation in an airplane.

Fire extinguishing equipment and techniques aboard aircraft are based on national fire codes and publication of the National Fire Protection Association. These do not differ significantly from those recommended for fire control in any environment. These codes are compiled by experts with a single purpose of providing the most effective methods of extinguishing fires. Fire-related accident studies show that passengers and crews have generally functioned effectively to detect and extinguish inflight fires in occupied zones with the existing fire extinguishing equipment.

Smoke detection and built-in fire extinguishing systems are installed on aircraft as required for extinguishing fires in unoccupied cargo and lavatory compartments. Galleys and lavatories have been fire hardened by fully enclosed waste storage compartments of fire-resistant materials. Requirements for the removal of smoke and toxic fumes in the event of an aircraft fire are established in part 25.831 of the Federal Aviation Regulations.

The smoke and fire evacuation procedures are developed by the aircraft manufacturer by using stringent failure mode analyses, considering human factors, passenger safety and effects on aircraft systems such as pressurization, cabin temperature, and so forth.

These procedures are demonstrated to the FAA during aircraft certification and when approved, are made a part of the FAA approved flight manual.

Senator INOUYE. Mr. Reese, may we take a short recess at this juncture? Otherwise, I will miss the vote.

Mr. REESE. Certainly.

[A short recess was taken.]

Senator GOLDWATER [presiding]. The committee will come to order.

Had anyone started to testify?

Mr. REESE. Yes, sir.

Senator GOLDWATER. Go right ahead, Mr. Reese.

Mr. REESE. Federal regulations require that the pressure in passenger cabins should not exceed that equivalent to an altitude of 8,000 feet; more typical values are 5,000 to 6,000 feet. The typical cabin altitude rates of change are 500 feet per minute increasing altitude and 300 feet per minute decreasing altitude. Such rates are less than those occurring in high-speed elevators. The latter figure is equivalent to an automobile at 55 miles per hour on a 1 in 16 gradient. The effects of reduced pressure in flight on passengers suffering from cardiac or pulmonary problems have been investigated by the medical community, supported by industry and Government agencies. The medical profession is well aware that aircraft operate at reduced pressures and advise their patients accordingly.

Any increase in design cabin pressure; for example, a decrease in cabin altitude, would result in significant increases in airplane structural weight and in extraction of more engine bleed air at higher pressures. This in turn translates into higher costs to the

traveling public. As an example, decreasing the cabin altitude of a new airplane the size of a 747 by 3,000 feet would result in a structural weight increase of about 2,500 pounds, resulting in an increased fuel cost of $32 million annually for a fleet of 400 airplanes.

For an existing airplane such as the 747, the result would be to limit the cruise altitude to 33,000 feet, costing $375 million annually for the fleet.

Again, this legislation is not required and is redundant to the broad charter already given to the FAA. More detailed information supporting the AIA position is attached to the statement submitted.

Thank you, sir.

Senator GOLDWATER. Have you completed your statement?

Mr. REESE. Yes, sir.

[The following information was subsequently received for the record:]

QUESTIONS OF SENATOR INOUYE AND THE ANSWERS THERETO

Question 1. Please state your full name, title, work address and telephone number where you can be reached at the Aerospace Industries Association of America, Inc. (AIA).

Answer. John P. Reese, Director, Airworthiness Programs, Aerospace Industries Association of America, Inc., 1725 De Sales Street NW., Washington, D.C. 20036 (202) 429-4666.

Question. Please identify the name(s) and title(s) of all persons assigned and/or assisting in the preparation of the responses to these interrogatories.

Answer. Those individuals assisting in the preparation of the responses to these interrogatories, under the authority of the Aerospace Industries Association of America, Inc. (AIA) and with the full knowledge and approval of the members of AIA, are as follows:

A. J. P. Lloyd, Manager, Mechanical & Electrical Systems Research, Boeing Commercial Airplane Company; J. R. Withee, Chief Design Engineer, Design and Analysis Propulsion Systems Engineering, Douglas Aircraft Company; and P. F. Halfpenny, Group Engineer L-1011 ECS & Fluid Systems Lockheed California Company.

Question 2. The AIA maintains that the regulatory issues addressed in S. 1770 are being handled by the Federal Aviation Administration (FAA). Please identify all the studies, investigations, surveys, rulemakings and other sources of information upon which the AIA believes indicates that the FAA is in fact monitoring and handling these issues. Please supply copies of these materials for the record.

Answer. The AIA believes that the FAA's performance in handling the regulatory issues is adequate; however the details of how regulations are monitored are best obtained from a review of FAA records and reports and suggests that FAA be contacted for these data.

Question 3. Please identify the materials, tests, investigations, reports, surveys, case studies and other sources of information that form the basis of the AIA's proposition that "Industry practices and standards, and the FAA rules, regulations, and standards are non-discriminatory, and in conformance and parity with non-aviation standards, and regulations." Please submit a copy of these above described materials to your answers to these interrogatories.

Please identify the materials, tests, investigations, reports surveys, case studies and other sources of information that form the basis of the AIA's proposition that "Industry practices and standards in certain areas surpass non-aviation standards, practices and regulations." Please submit a copy of these above-described materials to your answers to these interrogatories.

Answer. The basis of the AIA's proposition that the industry practices are equal to or surpass non aviation standards is based on the design, development and certification procedures followed by the aviation industry which are much more stringent than non aviation practices.

Examples are as follows:

The aircraft specifications define the required fresh air flows for all operations; they specify maximum and minimum air velocities in the passenger area; they limit the cabin temperatures to a narrow comfort band; they limit the temperature rate of change; and they limit the temperature variation within the occupied areas.

During the development of the aircraft, full scale mockups are used to demonstrate and evaluate the air conditioning systems. Jurys consisting of airline representatives, typical passengers, and the engineering designers evaluate the system. Smoking machines have been developed to evaluate the effectiveness of the system in dissipating cigarette smoke. Techniques used by the manufacturers in developing systems although similar, are treated as trade secrets and are valuable proprietary assets. Typical developmental photographs showing tests with simulated passenger heat loads (Figures 29 and 37) and a smoking machine Figure 28 are attached to illustrate some of these aspects.

The AIA believes that the non-aviation industry does not expend this type of effort in development of air conditioning systems.

Question. Please identify the materials, tests, investigations, reports, surveys, case studies, and other sources of information that form the basis of AIA's proposition that "Industry practices and standards are continuously improved."

Answer. AIA's proposition can be illustrated by considering the case of ozone. When it was realized that ozone could be a problem under certain conditions, the industry (and FAA) improved their practices and standards in order to reduce the ozone level to acceptable values, thus ensuring the welfare of the traveling public.

The development of ozone control equipment, adsorbers and catalytic converters, was begun when the problem was identified, well in advance of any regulatory requirement. Competition between manufacturers also helps to ensure continued improvement in systems and practices.

Question. Please identify the materials, tests, investigations, reports, surveys, case studies, and other sources of information that form the basis of AIA's proposition that "the proposed study is unnecessary and would not be a judicious expenditure of taxpayers' money."

Answer. AIA's proposition is based on its belief, supported by its verbal and written testimony, that the cabin environment meets or exceeds non-aviation standards, practices and regulations.

Question. Please identify the current fresh air ventilation rates that are provided by the airlines. In addition, please identify the number of complete air changes that occur in the various kinds of aircraft.

Answer:

Airplane	Fresh air ventilation rate (c.f.m.)		Number of air changes per hour Based on total flow	
	Cockpit	Cabin	Cockpit	Cabin
727-200	240	2,600	42.6	23.6
737-200	140	1,750	35.0	22.7
747-100/200	310	5,600	20.0	17.3
747 SP	310	5,600	20.0	20.4
DC9-30	290	2,050	68.4	28.0
DC9-80	280	2,000	66.5	25.8
DC10-10	370	5,750	56.4	25.1
L-1011-1/500	300-400	5,700	45.0	18.0-20.0
757	280	1,600	60.0	30.0
767-200	270	2,300	60.0	25.0

Question. Please state whether airlines are currently allowed to recirculate air in an aircraft. If so, please describe the kinds of filter systems available in various types of aircraft that are currently certified.

Answer. Some airplane ventilation systems incorporate recirculation subsystems and the normal mode of operation includes use of recirculation.

FILTERS AVAILABLE IN RECIRCULATION SYSTEM

Airplane	Filter type	Efficiency
DC8-61, 62, 63	Particulate	76 percent efficient in removing ASI test dust.
DC9-80		90 to 95 percent efficient in removing Atomospheric air stain.
DC10, 747, 757, 767		95 to 98 percent efficient using a DOP type test (MIL-STD-283).

Question. Please state whether current FAA rules and regulations allow airlines to operate with less than all air ventilation packs operating? If so, please identify proper authority (regulations).

Answer. Since this query is directed toward FAA rules, AIA prefers that the FAA respond to this item.

Question. On Page 11 of the Appendix to the AIA's written testimony, protective breathing equipment is discussed. The AIA states that, "Both the crew and passengers are provided emergency oxygen identified by the FAA as supplemental oxygen." Please identify what supplemental oxygen is available for passengers and crew in the event of an inflight fire generates toxic fumes.

Answer. Supplemental oxygen, as the name implies, is oxygen added to that existing in the inspired air. Two (2) methods are in use for providing this oxygen; one uses regulated pressure from a cylinder containing gaseous oxygen, and the other generates oxygen by a chemical reaction. All of the flight crew systems are of the stored gas variety. Early passenger systems also use the stored gas approach and the more recent installations employ chemical oxygen generators. The flight crew system and the passenger system are completely independent.

With the stored gas systems, the amount of oxygen available is determined by the pressure regulator. This regulator automatically controls the pressure as a function of cabin altitude so that as the cabin altitude increases, higher flows are provided.

The chemical generators provide a preprogrammed oxygen flow rate as a function of time. The flow is established to meet the requirements of an assigned descent profile.

These systems are designed for use during cabin decompressions and provide very little supplemental oxygen at normal cabin pressures. Even the volume flow from the chemical generator is low when produced at normal cabin pressure.

Question. AIA also states that the flight crew has the capability to obtain undiluted oxygen when needed. What is available for the flight crew? What is available for the cabin crew? What is available for the passengers?

Answer. The flight crew system is independent of the passenger system and incorporates a means for each crew member to individually select a 100% oxygen supply to the mask.

All airlines provide supplemental oxygen for the cabin crew and passengers. As mentioned above, the supplemental oxygen system provides little benefit at normal cabin altitudes. The cabin crews have access to portable oxygen supplies which are equipped with full face masks.

Question. Finally, in that same paragraph the AIA states that, "Passengers, in most instances, obtain a mixture of oxygen and the surrounding air." Please clarify for the record the instances under which the passengers will receive this mixture. How is this accomplished in a smoke filled cabin due to an inflight fire situation? How successful would this mechanism prove if used as smoke protection equipment?

Answer. The passenger oxygen masks are deployed automatically during a decompression before the cabin altitude reaches 15,000 feet. They can also be deployed manually by the flight crew at any cabin altitude.

The passenger system is a continuous flow system with the flow rate established to accommodate the cabin altitude. This oxygen is dispensed through a reservoir bag to the face mask. During the exhalation portion of the breathing cycle, oxygen accumulates in the bag and is available during the inhalation portion of the cycle. When the bag has emptied and the inhalation is not complete, an inhalation valve opens to let air into the face mask. The quantity of air that enters the mask will depend upon the quantity of oxygen in the bag, the tidal volume of the user and the breathing rate.

Except for a short period after a high altitude cabin decompression, the passengers will receive a mixture of supplemental oxygen and surrounding air. At normal cabin pressure, little benefit is to be gained from this system in a cabin smoke situation.

Question. Poor visibility according to the FAA, ATA, and AIA is one reason why emergency oxygen masks or hoods have been determined inadequate. Visibility in a smoke filled environment is already minimal without the use of masks or hoods. The primary concern in such an environment should be to keep passengers and crew alive in order to evacuate. Don't you think that passengers would prefer to have inadequate visibility in order to stay alive, than perfect visibility and 90 sec-

onds to live in a smoke filled passenger cabin? Please identify the number of studies that occurred on this matter and whether or not the AIA has participated in such studies. This information should include the dates of such studies, any findings or conclusions, names and identities of the participants, and any published reports.

Answer. The AIA conducted a crashworthiness development program in 1968, which included testing ten prototype smoke protective devices submitted by eight safety equipment companies. Eight of these devices were smoke hoods and the other two were commercially available devices with nose clips and filtered breathing through a mouthpiece. One series of tests used exposure to a white irritant smoke. The results showed that very small amounts of air leakage past elastic or lanyard neck seals caused choking sensation in the wearer, causing the tests to be terminated in 2½ minutes or less. In another test run in a heated noxious environment, the experimenter lost consiousness at 140 seconds using a smoke hood that had passed 6 minute laboratory tests, thus showing it is very essential to test hoods under realistic conditions. Three brands of smoke hoods were evaluated during aircraft evacuation tests. In general, the heavier and darker the simulated smoke, the higher the percentage of test subjects who removed the hoods during the evacuation. Reasons for removal included trying to obtain better visibility, obtain better hearing, having difficulty in breathing, not having the hood on properly, need to reposition too often, and a general feeling of anxiety produced by the hood. Evacuation times were faster in comparative tests when hoods were not provided.

Question. Please identify the source of the cockpit compartments fresh air ventilation. Please identify if such source is the same, identical or different source of the fresh air ventilation received by the passengers. Please state the current design capabilities of the fresh air ventilation equipment for the cockpit compartment in cubic feet per minute per person. Please state the current design capabilities of the fresh air ventilation equipment for the passenger compartment. Please explain the differences in providing the different levels of fresh air.

Answer. The source of the cockpit compartment fresh air is the same as for the cabin. Both are supplied from the engine bleed system through the air conditioning packs.

In general, all air conditioning packs are cross connected through ducting or into a plenum to supply the cockpit and the cabin zones so that failure of one of the packs results in a uniform reduction in flow to all zones. Specific cockpit flows are shown in the response to interrogatory 7. These flows translate into vantilation rates ranging from 70 CFM per person on a B737 to 14 CFM per person on a B757 based on two occupants.

The ventilation per passenger varies from 15 to 22 CFM for current production aircraft with an average of 19 CFM per person. These data were provided for each aircraft to the committee as part of the AIA submittal of May 20, 1982.

The reasons for the higher ventilation rates in the cockpit are primarily to meet the increased cooling load associated with the cockpit. The large glass areas add a very large solar load and thermal radiation from flight instruments combine with the solar load to establish the air requirement. Furthermore, the cockpit air is used to cool avionics equipment in a single draw through pass and this requires relatively high flow.

Finally, cockpit ventilation must be adequate to ensure rapid smoke cleaning in event of equipment fire or smoke so as to maintain visibility for crew functions.

Question. It has been brought to the attention of this subcommittee that more than two decades ago pilots were raising similar complaints of those being raised now by flight attendants. While the industry has corrected this problem, it has avoided even the impression of credibility for complaints by others. Please provide AIA's position on the reason for the apparent resolution of the pilots' concerns yet no recognition of the flight attendants' complaints.

Answer. AIA members respond to valid complaints from any crew member through airline inputs and with the airlines will undertake corrective action. As an example, nearly all of the complaints regarding ozone originated with the flight attendants. There were very few pilot complaints regarding ozone.

Question. While the cooling of avionic equipment may be one reason for a separate fresh air system for the cockpit crew, the subcommittee is aware that recirculated air can be used to accomplish the same effect.

Answer. The AIA agrees that avionic equipment can be cooled using recirculated air and designs of the B767 and B757 use this concept. However, existing avionics packages are not readily convertible to recirculation cooling.

Recirculated air is used in the flight deck on some aircraft; for example the B767 and B747 in some modes of operation.

A reduction of air flow into the cockpit would be welcomed by flight crew members and system designers, since the high ventilation rates needed to cool the cockpit create distribution problems in eliminating drafts.

Question. Please state whether AIA or its members were ever consulted by the airlines about the effect of operating inflight with less than all ventilation packs operating? If so, please state when, the substance of that contact, and the parties participating in such contact. Does the AIA condone such action? Why?

Answer. Operating airlines have asked the AIA members what the effects of reduced ventilation would be on the cabin environment. Specific questions have covered pressurization, repressurization, tobacco smoke dilution, CO_2 and CO concentrations, and temperatures in the cabin with reduced flow.

The AIA members have provided the effects of less than full ventilating on each of these parameters. In general, ventilation may be reduced when passenger loads are reduced. The systems are designed to provide full comfort with 100 percent occupancy and some reduction in flow is permitted.

However ventilation must be maintained at a level to ensure good circulation, flow distribution, and temperature control.

Question. Please supply for the subcommittee the basis for the estimated cost to the airline industry stated in the testimony of AIA.

Answer. The AIA testimony refers to two cost estimates, the first relating to increased fresh air rates and the second to increased cabin pressure.

In the case of increased fresh air rates, the calculations are presented in detail in Appendix II of the AIA testimony. These calculations show that the cost of providing a fresh air rate of 50 CFM per passenger (a number used in a recent petition submitted to and rejected by the FAA) would be in excess of $633 million annually for the 727 fleet and $1.3 billion annually for the 747 fleet. These numbers are based on an assumed fuel cost of 1.19/gallon, and may be scaled for any other fuel cost.

[Amounts in dollars]

Cost of fuel dollars/gallon	727 annual cost increase (billions)	747 annual cost increase (billions)
1.00	[1] 532	1.092
1.50	[1] 798	1.639
2.00	1.064	2.185

[1] In millions.

It should be noted that these costs are for the additional fuel alone. Substantial additional costs would be incurred for developing new equipment. For example, current engines are not capable of providing such high air flow rates.

The cost impact of increased cabin pressure is different for new and existing aircraft. For a new aircraft, the size of the 747, the structural weight penalty associated with designing for a maximum cabim altitude of 5000 feet (as an example) would be approximately $33M annually for a 400 airplane fleet. This figure is based on the same calculation approach as in Appendix II, and is based on fuel at $1.19/gallon. Again, the cost figure can be scaled for different fuel prices. For an existing airplane, the effect is to limit maximum cruise altitude (in this case to 33000 feet) resulting in less efficient operation. The resulting costs of $325M annually can be scaled for different fuel prices.

Question. Please supply for the Subcommittee, AIA's estimate of the cost per passenger that would result from an increase in fresh air ventilation to a more than adequate level.

Answer. AIA maintains that fresh air rates are already more than adequate.

The costs of providing 50 CFM per passenger of fresh air are discussed above. On a per passenger basis, the cost for the 747 (assuming an average 4.35 hour flight, an average 60 percent load factor, and fuel at $1.19/gallon) would be $17. For the 727, the comparable figure for a typical flight (1.54 hours) is $2.75. These numbers may be scaled for different fuel prices.

Question. Does the AIA collect information concerning the number of passengers that experience some kind of medical difficulty prior to a flight, during a flight, and after a flight?

Does AIA know of any governmental, private or quasi-governmental entity that does collect such information? If so, please identify.

Answer. The AIA does not maintain records of passenger medical problems. In flight accident data including cuts, fractures, except for those to fingers, nose and toes, and any medical problem requiring hospitalization over 48 hours, are supplied to NTSB. A study on the scope of ambulatory monitoring in ISCHEMIC heart disease was conducted through the AMA and the University of Hawaii. (The Library of Congress Catalog data and the list of sponsors is attached.)

Question. While fire extinguishing equipment and techniques aboard aircraft are based on National Fire Codes, has AIA considered the fact that such code approved equipment for non-aviation incidents may very well contribute to exacerbation of a problem in the aviation environment? Please describe and identify the case studies and tests, surveys or other informational sources that AIA has consulted in this matter.

Answer. Fire extinguishers installed on aircraft must be approved by FAA (FAR 25.851 (a) (1)). This approval is based on Underwriter Laboratories (UL) tests and fire extinguisher effectiveness ratings. In addition, the extinguishent must be designed to minimize the hazard of toxic concentrations and in this regard, not exacerbate fire problems. Ratings for extinguishents regarding toxicity are published by UL, titled "Classification of Comparative Life Hazard of Gases and Vapors".

Question. AIA states that this legislation, S. 1770, is not required and is redundant to the broad charter given the FAA. Please identify all studies, tests, case histories, investigations, and other sources of information that have been conducted by the FAA in the issues provided in S. 1770. Please specify the reports, kinds of facts and conclusions that reflect such redundancy, complete with dates, and the names and entities of the participants in such studies.

Please specify if AIA has participated in any of these studies.

Answer. AIA members have individually supported FAA tests and investigations in the past; however, it is felt that the FAA should supply this information since that agency would have all the records.

Question. On Page 2 of the AIA Appendix I, FAR 25 requirements are stated as, "Each passenger and crew compartment must have enough fresh air (but no less than 10 CFMP per crew member) to enable crew members to perform their duties without undue discomfort or fatigue. . . ."

According to my information, the correct wording of FAR 25 is "(a) Each passenger and crew compartment must be ventilated, and each crew compartment must have enough fresh air (but not less than CFM per crew member) to enable crew members to perform their duties without undue discomfort or fatigue."

Will AIA please explain the discrepancy in definitions and cites?

Answer. It appears that both FAR quotes were subject to typographical omissions. If the parenthetical expression in the second quote above is modified to read: ". . . (but not less than 10 cu. ft. per minute per crew member) . . .", the wording of 25.831(a) is as shown in the CFR of January 1, 1981.

Question. AIA states that ventilation rates far exceed the 4 CFM/person minimum required to control CO_2 and replace oxygen. Please identify whether the AIA statement above reflects fresh air ventilation? or whether it refers to recirculated air?

Answer. The statement reflects fresh air.

Question. AIA states that actual aircraft ventilation rates range from 15 to 25 CFM/person based on a 100 percent load factor. Please identify whether the AIA statement above reflects fresh air ventilation or recirculated air? Please state for the record whether these are design capabilities or operational figures? If the above statements are operational figures, please provide the studies investigations, reports and other materials which form the basis for such statement.

Answer. AIA members normally define ventilation rates as total flow. The values are design values.

Senator GOLDWATER. All right. We will have Mr. Collier next.

STATEMENT OF J. DONALD COLLIER, DIRECTOR, ENVIRONMENTAL AFFAIRS, AIR TRANSPORT ASSOCIATION OF AMERICA, ACCOMPANIED BY W. H. SPANNUTH, DIRECTOR, AIRCRAFT SYSTEMS AND STRUCTURES ENGINEERING, TRANS WORLD AIRLINES

Mr. COLLIER. Thank you, Mr. Chairman.

I am J. Donald Collier, director, environmental affairs of the Air Transport Association of America. I am accompanied by Mr. W. H. Spannuth, director, aircraft systems and structures engineering for Trans World Airlines.

We extend our thanks for your inviting the Air Transport Association, the ATA, to appear before the subcommittee to present our views on cabin air quality and related matters covered in S. 1770. One of the main questions raised by S. 1770 is the adequacy of FAA regulations and standards, and airline operating practices in assuring the satisfactory quality of the air supplied in flight to passengers and crewmembers. This is not a new subject inasmuch as the Federal Aviation Administration completed a review of this matter less than 15 months ago, in which the ATA, other aviation groups, and the general public were invited to participate. In our view, the FAA decision in that review, published March 30, 1981, to not amend the present Federal Air Regulations controlling air quality, was the correct one. The reasons are as follows:

First, the record and experience of over 20 years of jet operations are conspicuously quiet on health problems related to cabin air quality. Low air humidity has long been recognized as a consideration in jet flight, but is simply and fully accommodated by adequate fluid intake on the part of people aboard. While cabin humidity sometimes drops to levels that may be uncomfortable to some sensitive individuals, we know of no evidence that relates health problems to low humidity over stretches of time typical of commercial flights. The substantial cost of augmenting cabin humidity by current technology is unjustified by the infrequent incidence of temporary discomfort.

Second, ventilation rates provided in current aircraft systems are better than minimum standards recommended for other public facilities. Aircraft dominating the U.S. airline fleet today provide a ventilation rate of 25 to 40 cubic feet of air per minute per person, which exceeds the 5 to 25 cubic feet per minute range recommended by the American Society of Heating, Refrigeration, and Air-conditioning Engineers for various nonaviation environments. In the aforementioned FAA review, the docket contains manufacturers' estimates that the cost of increased ventilation rates to the levels proposed would be $1.3 billion for the B-747 fleet alone. Further, we have seen no evidence that ambient or transient cabin air pollutants exceed the limits presently specified in the FAR's.

As this committee may be aware, an atmospheric quirk some years ago caused a rash of reports of temporary bronchial irritations. Investigations revealed abnormal concentrations of ozone on flights at high altitude operating at the northernmost latitudes. Those aircraft engaged in high altitude, long distance travel have since been modified with systems that destroy excess ozone in the cabins, and procedures have been devised for avoiding areas of

highest ozone concentration. This is mentioned so as to preclude a potential confusion of ozone-related problems with the air quality issues raised in S. 1770.

Civil Aeronautics Board consumer complaint data is silent on the subject of air quality other than the issue of tobacco smoke. S. 1770 does not specifically address smoking on board aircraft, so we have not expanded our remarks on this aspect of cabin air quality.

With respect to the other issues in S. 1770 not covered in the referenced FAA review of air quality, namely, emergency breathing equipment, fire extinguishment, and safe pressurization, we are aware of no problems which indicate a need to again review the current regulations, standards and procedures. In 1980 an industry team established by the FAA, the Special Aviation Fire and Explosion Reduction Advisory Committee, completed a review of this general subject. While acknowledging the current enviable airline safety record and the resultant relatively small number of fatalities, the committee report recommended several areas of research, development and regulation for future application to aircraft.

In summary, the airlines have established a remarkable record in travel safety and health. It is our belief that the past two decades of jet passenger service have established the adequacy of current aircraft environmental control systems. We think that further expenditure of public funds on this question, as proposed by S. 1770, is unnecessary particularly in the wake of FAA's thorough investigation of these issues in the two projects mentioned.

That completes my prepared statement, Mr. Chairman. Mr. Spannuth and I will be happy to respond to any questions the committee may have.

Senator GOLDWATER. Thank you very much, Mr. Collier.

QUESTIONS OF SENATOR INOUYE AND THE AIR TRANSPORT ASSOCIATION ANSWERS THERETO

Question 1. Please state your full, title, work address and telephone number where you can be reached at the Air Transport Association (ATA).

Answer. J. Donald Collier, Director, Environmental Affairs, Air Transport Association of America, 1709 New York Avenue NW., Washington, D.C. 20006 (202) 626-4017.

Question 2. Please identify the name(s) and title(s) of all persons assigned to and/or assisting in the preparation of the response to these interrogatories.

Answer. J. Donald Collier, Director, Environmental Affairs, Air Transport Association of America (ATA), Lawrence E. Gillespie, Manager, Flight Operations, Air Transport Associations of America (ATA), Interrogatories No. 17 and 20; assisting with Nos. 4 and 5; and W. H. Spannuth, Director, Aircraft Systems and Structures Engineering, Trans World Airlines, Inc., Assisting with Interrogatories Nos. 8, 9, 11, 13, 14, 15, and 16.

Question 3. Please identify the authority under which you are answering these interrogatories, and whether you are answering them on behalf of and with the full knowledge and approval of the ATA and its membership. If not, please identify the person(s) whose views are expressed herein.

Answer. These responses have been prepared by the named individuals with the full knowledge and approval of the appropriate ATA supervision. Responses are based on the expertise of the named individuals and their familiarity with the procedures and experiences of the ATA member airlines. Teletype inquires to airline members were distributed in order to respond to Interrogatories 11 and 15. Due to the constraints of time, more extensive polling of members was not conducted. None of these responses were circulated to ATA members for specific approval.

Question 4. Please state whether the ATA, or any subdivision of ATA or any organization at the direction of ATA, receives, on a continuous basis, passenger and/or

flight crew complaints, regarding problems of any kind, experienced during the operation of any flight, from the members of the ATA.

Answer. The ATA is not involved in any way with the continuous receipt of passenger or flight crew complaints.

Question 5. Please state whether ATA is aware of its members receiving complaints of the kind mentioned in the previous question.

Answer. ATA is aware whether that its members do receive complaints from passengers and/or crewmembers regarding perceived problems experienced during flights.

Question 6. According to the House Hearing Report Concerning FAA Aviation Safety Issues, the Independant Union of Flight Attendants formally requested, in March 1978, that the California State Department of Health look into the flight attendant complaints. Based on 200 complaints, the California Department of Health decided there was strong enough evidence requiring a study. Is ATA aware of these Hearings, the complaints, the California State Department of Health's study and its conclusions? If so, please state on what basis ATA can maintain that the record and experience of over 20 years of jet operations are conspicuously quiet on health problems relating to cabin air quality?

Answer. ATA has a copy of the House Hearings Report concerning FAA Aviation Safety Issues to which is appended the study conducted by the California Department of Health Services in concert with the Independant Union of Flight Attendants and the Center for Disease Control (the California Study). The pertinent sections of that Report have been reviewed.

First, we note that the California study involved itself extensively with the cabin ozone issue which at that time was still a matter of pending FAA rulemaking action. While we do not here address the merits of ozone regulation on aircraft, the ozone issue as addressed by the California study is mooted by ensuing enactment by FAA of FAR 121.578 (see Attachment I hereto)[1] and the associated measures taken by airlines to reducing exposure to ozone. Our opening statement before this subcommittee took cognizance of this development and excluded the ozone-related issues from subsequent discussions regarding cabin air quality.

Second, we observe that the California "study" was based on a mere questionnaire distributed to a limited segment of the flight attendant population seeking subjective evaluation of their health. There is no evidence that a non-aviation control group was queried, nor that medical examinations by competent physicians were made, nor that any attempt was made to correlate symptoms with smoking habits, extra-curricular activities, medical histories or health conditions. Furthermore, the survey appears to present a biased viewpoint: the solicitation said, "we have all suspected our working environment and conditions to be the cause (of various health problems during flight). The only way to prove it is through a study of this type." (Committee Report p. 320). The survey presumed health problems to exist and was designed to elicit a listing of such from the respondent.

In summary, it is ATA's position that, while the California study may document a number of complaints, it stops well short of establishing a health problem, and, other than the aforementioned ozone issue it neither alleges nor establishes a connection with cabin air quality.

Question 7. According to P. F. Halfpenny, Group Engineer, L-1011 ECS, Lockheed California Company, author of Aircraft Humidification System Development:

"Air humidification systems have in the past had operational and maintenance problems that have caused most airlines to consider the concept impractical. However, as flight segment lengths have increased, the adverse physiological effects of low humidity have become more pronounced and consideration has been given to developing systems more compatible with the airline operations.

"Relative humidity in the flight station typically is less than 5% and this has been shown to adversely affect crew comfort, performance and health. Similar effects are reported by flight attendants and passengers where cabin humidity is as low as 5 to 7 percent."

In view of Mr. Halfpenny's above remarks, please explain and identify for the Subcommittee, the facts and information that form the basis of ATA's statement that "while cabin humidity sometimes drops to levels that may be uncomfortable to some sensitive individuals, we know of no evidence that relates health problems to low humidity over stretches of time typical of commercial flights."

Answer. The referenced document appears in our files as American Society of Mechanical Engineers publication number 79-ENAs-8 of the same title and author, for presentation at the Intersociety Conference on Environmental Systems, July 16-19,

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[1] Attachments I-XII are in the Committee files.

1979. Since the author is identified as an engineer, the medical conclusions quoted in the interrogatory are presumed to originate elsewhere. No references are cited in the paper, however, and therefore we are unable to further investigate those statements.

ATA's position is based on several factors. First, the Federal Air Regulations are devoid of specific requirements relating to cabin humidity—this, despite exhaustive regulation of the pilot compartment (14 CFR 25.771), pilot compartment doors (Sec. 25.772), pilot compartment view (Sec. 25.773), windshields and windows (Sec. 25.775), cabin doors (Sec. 25.783), seats, berths, safety belts, and harnesses (Sec. 25.785), stowage compartments (Sec. 25.787), loose items in passenger and crew compartments (Sec. 25.789), passenger information signs (Sec. 25.791), floor surfaces (Sec. 25.793), emergency evaluation (Sec. 25.803), emergency exits (Secs. 25.805, 25.807, 25.809, 25.811, 25.812, 25.813), width of aisle (Sec. 25.815), maximum number of seats abreast (Sec. 25.817), ventilation (Sec. 25.831), cabin ozone (Sec. 25.832), heating systems (Sec. 25.833), pressurized cabins (Secs. 25.841 and 25.843), fire extinguisters (Sec. 25.851 ff), safety belts (Sec. 25.1413) ditching equipment (Sec. 25.1415), megaphones (Sec. 25.1421), pressurization and pneumatic system (Sec. 25.1438), protective breathing equipment (Sec. 75.1439) oxygen equipment and supply (Secs. 25.1441, 25.1443, 25.1445, 25.1447, 25.1449, 25.1450), fire protection for oxygen equipment (Sec. 25.1451) and many other matters. Thus, a prima facie case exists for holding that the humidity question has not presented itself as requiring regulatory control. This is supported by FAA internal correspondence (see Attachment II) which concludes that ". . . there are no data available in the literature which indicate decrements in performance when an individual is exposed to normal temperature (70–75 deg. F) and low humidity (<20% RH) for a few hours. There are isolated reports that drying of the mucous membranes and conjunctiva can occur." "The question of humidity control for aircrew is thus a question of comfort and not one of safety, if exposures are not prolonged."

Second, the experience of 16 ATA member airlines has been represented to the ATA in correspondence which is summarized in Attachment III. These 16 airlines operate aircraft constituting 85% of the total fleet of the ATA member airlines. The comments reflect the fact that a very small segment of passenger and crew population are discomforted by low humidity. These complaints seem to be associated with flight under circumstances where ozone concentration may have been expected to be high, thus it is not certain that humidity alone was responsible. Those airlines reporting such complaints had not at the time of making these reports incorporated ozone-reduction measures as they currently are pursuant to FAR 121.578.

The ATA position also draws from the position of the Aerospace Industries Association, which represents the airplane manufacturers. In its comments to FAA on the Xenex Corporation Petition, Docket No. 20351, the AIA stated, "Humidity levels in aircraft cabins are typical of what occurs in many parts of the world in desert areas or during the winter months when the outside air temperture drops below 25 deg. F. No data exists to indicate that low humidity poses any safety hazard to the public. In fact, studies have shown there is no physiological need for humidification of air."

Attachment IV represents the most solid research that we have seen on the humidity issue. This careful study, assisted by Dr. D. F. Proctor of the John Hopkins School of Hygiene and Public Health, concludes—after monitoring nasal mucous flow rate, nasal resistance, forced vital capacity, skin resistance and discomfort in eight men exposed to humidity ranging from 10% to 70%—that there is no physiological need for humidification of air.

Finally, ATA relies on FAA's Denial of Petition re Docket No. 20351, dated March 3, 1981, which states, "Xenex fails to show that there is a physiological need for such high levels of humidification during flight. Although human comfort may be affected by humidity, no evidence is presented by the petitioner to allow the conclusion that humidity, or lack of it, causes health problems in normally healthy people."

Question 8. In a 1952 survey conducted by the A–9 Committee of the SAE, flight crews complained about the discomfort of the dry cabin air, the increased incidence of colds, and the debilitating effects of smoke and odors resulting from recirculation of cabin air into the flight station. As a result of these objections and other developments, regulations have been established that require that the flight station be supplied with 100% fresh air through an independent temperature control system. Please cite the regulations that are mentioned above, and indicate whether that ATA and/or its members are aware of this 1952 survey.

In view of the above 1952 survey and the regulations subsequently adopted, please explain the basis of the ATA's position that the record and experience of over 20

years of jet operations is conspicuously quiet on health problems relating to cabin air quality.

Answer. No records are available in the files of those aforemaned respondents. Neither do our records reveal if and how such a survey manifested itself into a regulation. ATA has not polled its members regarding the subject survey and its relation to any regulations inasmuch as the FAA docket is a more authoritative source, and there is low expectation of finding documented evidence of this vintage among airlines.

The current regulation governing aircraft ventilation is 14 CFR 25.831, reproduced in Attachment V. While this regulation, in Sec. 25.831(e), provides for independent control of air temperature and ventilating air quantity in the flight crew compartment, we are unable to find the stated requirement for either an independent control system or for 100% fresh air.

The ATA comment regarding 20 years of jet operations without evidence of health problems related to air quality is not challenged by the presence of a 30-year old survey predating jet commercial services. Jet operations are far superior to pre-jet conditions in many respects, one of which is the greatly reduced time in flight for a given trip, which would have a significant bearing on crew reactions to cockpit discomforts.

Question 9. Please explain the ATA's rationale for recognizing that prior complaints have resulted in regulations for cockpit crews while maintaining it is unaware of current problems experienced by cabin crew and passengers in the area of health affects due to cabin air quality.

Answer. FAA's regulatory procedures are based on the philosophy that any person can complain about any regulatory matter. Depending upon the quality and quantity of supporting data, a complaint may be rejected or it may lead to new or revised regulations. The system has not always worked perfectly, but it has been availing to many people for many purposes. By this rationale we presume, without reviewing the history of each FAR, that "prior complaints have resulted in regulations for cockpit crews." As previously stated, our files do not indicate whether or not this is the case regarding cabin air quality and the 1952 SAE survey.

ATA's statement about current problems among crews and passengers may have been misunderstood. We are certainly aware of complaints (see Attachment III), but we have qualified our statements in three ways:

(a) We excluded the ozone issue since it is a matter that has received regulatory action by FAA and is being redressed by incorporation of ozone reduction hardware and/or flight techniques;

(b) The tobacco smoke issue was excluded since it is primarily a comfort issue which has been carefully scrutinized by the Civil Aeronautics Board and—if vicarious consumption of tobacco smoke is eventually shown to be harmful to health—is a matter that needs to be resolved in the context of public places generally rather than in the context of aviation; and

(c) A complaint regarding health effects, in the absence of qualified medical observation, cannot be considered a health problem. ATA has stated that it is not aware of health problems, not that it is unaware of complaints, even though according to many airlines complaints are very rare.

Question 10. Please identify all studies and investigations that have been conducted by the FAA and/or AIA in which the ATA participated concerning issues raised by S. 1770 and any other issues that were considered by the Subcommittee during the hearing on S. 1770 on May 20, 1982. Please furnish a copy of any reports, conclusions, recommendations or other findings that are a result of these investigations.

Answer. Since this question relates to projects conducted by organizations other than ATA, it is believed that the Subcommittee would be better served by soliciting those other organizations directly. There are very few matters, if any, that the May 20, 1982 hearing touched upon that have not been a subject of FAA investigation at one time or another. Hence the studies and investigations of interest to the Subcommittee are in all likelihood already a matter of public record in FAA dockets. The foregoing notwithstanding, we are attaching a copy of one report recently brought to our attention by a member airline (Attachment XIII): "Cabin Air Pollutant Study Aboard Current Jetliners," Report No. D2-121323-1, The Boeing Company, circa 1969.

Question 11. It has been suggested that the ventilation rate aboard aircraft varies from 10 to 25 cubic feet per minute per person. Prior witnesses have testified that this level equates to about 3 to 5 times the ASHRAE standard for passenger transport aircraft.

Please state the ventilation rates currently provided by the airlines.

Please state what portion of this level is fresh air ventilation.

What are the regulations that ATA members must comply with concerning fresh air ventilation for cockpit crew, cabin crew and passengers? Please give full citation.

Question 15. Please state whether airlines are currently allowed to recirculate cabin air during a flight? If so, please describe the types of filter systems used in the various types of aircraft.

Please state whether current FAA regulations allow airlines to operate with less than all ventilation pacs operating? If so, please identify the current FAA regulations?

Answer. 11 and 15. ATA has polled its member airlines for specific ventilation rates and fresh air percentages for their various aircraft types. The results are tabulated in Attachment VI.

The regulations governing aircraft ventilation are set forth in Sec. 25.831, reproduced in Attachment V. Recirculated cabin air may be used subject only to the constraints of Sec. 25.831. Types of filtration employed in the various recirulation systems are reported in Attachment VI for each airline and aircraft type. Air conditioning (ventilation) packs may be partially or totally shutdown in flight subject to the continued compliance with Sec. 25.831 ventilation criteria and the Sec. 25.841/ Sec. 121.329 pressurization/supplemental oxygen criteria (see response to Interrogatories 13 & 14). The FAA Minimum Equipment Lists provide for each aircraft type the specific constraints, if any, imposed upon operation with reduced air conditioning supply.

Question 12. The FAA testimony also states that regulations specify a maximum carbon monoxide concentration of one part in 20,000 parts of air. This concentration amounts to 50 parts per million (ppm). Please state whether ATA finds this level reasonable and prudent. Please provide your rationale.

Answer. The pertinent regulation is Federal Air Regulation (FAR) 25.831 which is reproduced in Attachment V. The FAR imposes 50 parts per million (ppm) as a never-exceed limit for carbon monoxide (CO) for each passenger or crew compartment. This is similar to the U.S. Occupational Safety and Health Standard of 50 ppm time-weighted average maximum in any 8-hour work shift of a 40-hour work week. Theoretically the FAA standard provides more protection than the OSHA standard in some circumstances, and vice-versa in other circumstances, but the two standards are basically equivalent.

The U.S. Environmental Protection Agency national primary and secondary ambient air quality standards for carbon monoxide are (a) 9 ppm maximum 8-hour concentration not to be exceeded more than once per year, and (b) 35 ppm maximum 1-hour concentration not to be exceeded more than once per year. It is difficult to say whether the EPA and FAA standards are equivalent since EPA's statutory commission is different, and the standards reflect EPA's judgments regarding "adequate margin of safety" required to protect public health and welfare. In contract, FAA's congressional charter is expressed in terms of "safety", and OSHA's charter is expressed in terms of worker "safety and health."

In view of the equivalent or similar standards embraced by OSHA and EPA, FAA's present CO standards are deemed by ATA to be reasonable and prudent.

Question 13. The FAA testimony states that current regulations for pressurization require that the cabin altitude not exceed 8,000 feet for pressurized airplanes. Please state whether ATA considers this regulation a design or operating regulation, and give the full and proper citation.

Question 14. Are pilots allowed to exceed the 8,000 feet cabin altitude pressurization stated in the previous question during the operation of the aircraft? If so, under what circumstances, and what authority?

What are the current FAA operating regulations concerning cabin pressurization?

Answer 13 and 14. FAR 25 Section 25.841 provides certain design criteria for aircraft that are to be pressurized in flight (see Attachment VII). Section 25.841 is an airworthiness standard prescribed for the issue of type certificates (Section 25.1(a)). However, an airplane may be type certificated without the incorporation of a pressurization system, and "pressurized aircraft" may be flown with inoperative pressurization systems if flown under the rules governing unpressurized flight. In unpressurized flight, altitudes up to and including 10,000 feet may be flown with no special provisions for air flow or pressure; above 10,000 feet, unpressurized flight may be conducted provided supplemental oxygen is provided as detailed in Section 121.329, turbine-powered aircraft, and 121.331, reciprocating-engine aircraft. Section 121.329 is reproduced in Attachment VIII.

Question 16. According to testimony received, both the crew and passengers are provided emergency oxygen identified by the FAA as supplemental oxygen. Please identify the types of emergency situations in which this supplemental oxygen will

be utilized. Does ATA recommend such use in an inflight fire situation? If so, please explain, If not, please explain.

Please identify the emergency breathing equipment available for passengers and cabin crews in an inflight fire situation.

Answer. The regulations which govern required protective breathing equipment in contemplation of inflight fire are FAR 25.1439 and FAR 121.337, reproduced in Attachments IX and XII respectively. FAR 25.1439 and FAR 121.337(b) and (c), along with FAR 25.831, Ventilation (Attachment V), establish the minimum respiratory provisions for unpressurized flight at and below 10,000 feet altitude. For unpressurized flight above 10,000 feet altitude, supplemental oxygen equipment is required for sustenance according to FAR 121.329 (Attachment VIII), and this equipment must meet design standards of FAR 25.1441, .1443, .1445, .1447, .1449 and .1450 (Attachment X). Pressurized aircraft must provide supplemental oxygen to accommodate potential sudden depressurization, according to FAR 121.333 (Attachment XI).

Sudden depressurization is the only emergency contemplated by these regulations covering supplemental oxygen. The use of such equipment during an inflight fire is subject to the recommendations of the airplane manufacturer based upon system design. The following information from one ATA member explains the difference between two different designs:

"Boeing recommends not using the passenger supplemental oxygen sytem in a fire/smoke emergency while the cabin remains normally pressurized. This recommendation is based on the Boeing gaseous system delivering a very low level of oxygen in a normally pressurized cabin.

"Lockheed recommends using the passenger supplemental oxygen system in a fire/smoke emergency whether or not the cabin remains normally pressurized. This recommendation is based on the L1011 chemical oxygen generating system delivering a high flow of oxygen for several minutes regardless of cabin altitude."

Emergency breathing equipment available for crewmembers during an inflight fire is as established by FAR 25.1439 and FAR 121.337. The normal means of ventilation is relief upon for passenger air except in systems such as the Lockheed system just described.

Question 17. Do the airlines have some mechanism whereby flight attendant reports and/or complaints are collected? Please identify the procedure.

Please identify the procedure that occurs once a complaint has been received. Is the FAA made aware of these problems? Are airline manufacturers made aware of these problems? If so, how?

Answer. ATA member airlines do have in-place procedures available to their flight attendants to air their complaints. However, these procedures are not uniform and vary from airline to airline due to individual airline policies and organization. Most air carriers that we queried indicated that there were labor/management agreements that had established grievance/complaint procedures based on individual negotiations with each carrier.

The FAA has no regulatory requirements to receive individual flight attendant complaints. As previously stated these complaint procedures are handled individually by each airline. However, flight attendants either individually or through their union representative may forward their complaints to an FAA regional office or FAA Headquarters in Washington to receive a further review. After receiving the complaint the FAA can query the airline to ascertain the validity of the complaint and recommend corrected measures if warranted.

The complaint procedure could include the manufacturer if after an investigation by the airline some function of the aircraft or its associated equipment is implicated.

Question 18. In recent years, the House Subcommittee on Government Activities and Transportation has investigated the relationship between working conditions for employees in the aviation industry and air safety, and the actions taken by the FAA to promote safe and healthful working conditions on the ground. In its previous inquiries into this matter, the House Subcommittee has focused on efforts (or lack thereof) of the FAA to develop and enforce standards addressing working conditions for flight crews. Can you bring this Subcommittee up to date on the steps taken by the FAA to review existing problem areas and promote air safety for both ground maintenance personnel and flight crews?

Question 19. During these same hearings identified in interrogatory No. 10, a witness from the National Institute of Safety and Health (NIOSH) testified that the major problem in trying to regulate and enforce ground crew health and safety were the jurisdicational problem and the lack of research especially in the health effects of exposure to chemicals. This witness also emphasized that no one from the

FAA had every contacted NIOSH concerning the occupational health and safety aspects of airline carrier maintenance manuals. What, if anything, has the FAA done since these hearings in 1980, and previous House hearings in 1979, concerning the safety issues presented at that time? Are current FAA personnel capable of making medical decisions concerning the health and safety of airline employees? If so, please identify these people and include reference to their medical experience and education. Does the FAA have a policy that requires FAA inspectors to undergo OSHA training in an effort to recognize hazards?

Does the FAA nave any procedure of policy to ensure that maintenance manual provisions addressing or affecting the safety and health of airline employees are reviewed either by competent FAA, OSHA or NIOSH personnel to insure that the safety and health of such employees are not compromised by the manual provisions? Please identify these employees. When was this procedure established and why.

Answer 18 and 19. Since these questions relate specifically to FAA, not ATA, activities, it is suggested that more accurate and complete information could be obtained from FAA.

Question 20. According to a House report, airline maintenance and ground support personnel are exposed to carbon monoxide, polynuclear aromatics, and chemicals in jet fuel, jet exhaust, cleaning solvents and paint which are know to cause, inter alia, neurological damage, cancer, respiratory problems, heart disease, and skin and eye irritation. While this Subcommittee's review is not limited to airline maintenance and ground support personnel, what steps have the airlines taken in response to complaints concerning working conditions by flight attendants.

Has the FAA instigated any rulemakings? If so, please identify.

Has the airlines taken ay measures voluntarily. If so, please specify.

Has the FAA compelled the airlines to take precautions concerning these complaints? If so, please identify the action taken and when.

Answer. As stated in the answer to Interrogatory 17, ATA member airlines have in-place procedures for handling complaints from their employees. These complaint procedures are normally outlined in the labor/management agreements negotiated on an airline-by-airline basis. A specific example of management's attention to employees health concerns was highlighted in 1979 when flight attendants reported red blemishes appearing on their faces on certain aircraft operating over a certain route. The airline management took extraordinary steps to remedy the situation, to include medical and management personnel flying the route. From this were found to be harmless paint chips from the red identification markings on the survival vest. This is just one example of airline management's concern over the health and welfare of its employees.

A review of ATA records does not reveal that the FAA has instigated rulemakings specifically oriented toward improving flight attendant working conditions, although improvements resulting from such regulations as the ozone rule, FAR 121.578, would accrue to flight attendants as well as cockpit crews and passengers. On some occasions, the FAA will receive and investigate flight attendant complaints which, when validated, lead to recommended corrective measures issued via FAA internal Operations Bulletins to FAA inspectors assigned to the offending airline. The inspector in turn will confront the airline and seek compliance with the recommended action. In such cases the FAA must identify to the airline the complaints received and the corrective actions prescribed.

Question 21. (Supplemental dated June 21, 1982):

As a witness at the May 20th, 1982 hearings on S. 1770 by the Senate Subcommittee on Aviation, you heard first hand the comments made by other participating witnesses. Would you care to make additional comments concerning the testimony received that day? Please substantiate your comments.

Answer. ATA feels that the substantiation supplied in the foregoing responses sustains its original position that a study as proposed in S. 1770 is unnecessary. We have no additional comments at this time.

Senator GOLDWATER. And now we will hear from Mr. Werjefelt.

STATEMENT OF BERTIL WERJEFELT, PRESIDENT, XENEX CORP.

Mr. WERJEFELT. Thank you for the opportunity to present this testimony.

I would like to submit my prepared statement for the record and briefly summarize it here.

Senator GOLDWATER. That will be done.

Mr. WERJEFELT. My testimony indicates that pilots are given up to 150 cubic feet of fresh air per person per minute for health and safety reasons while occupants of the passenger cabin are provided only approximately 5 cubic feet per person per minute of fresh air, while at the same time facing the same health and safety hazards as the pilots.

My testimony also indicates that fatigue and jet lag may also be caused by the deficient environment on board. There is evidence of contagious diseases being spread on airplanes, partly due to the grossly inadequate fresh air ventilation. Influenza and chickenpox have been cited.

A study indicates that on a percentile basis, 6 to 7 of every 100 air travelers with certain heart trauma die within 4 days of air travel. These are frightening figures.

In the event of in-flight smoke and fire, there are no instructions whatsoever for passengers of what to do during such emergencies, none whatsoever. Neither is there any respiratory protection available for passengers against toxic fumes, contrary to widely held popular belief. Respiratory protection for cabin crew against toxic fumes is not required by law and is often not available to them. Respiratory protection for flight crews is inadequate based on experience and statements made by industry officials.

To put perspective on the matter, there are approximately 300 million air travelers annually in the United States alone that are affected. Economic losses to the public and U.S. industry due to the absence of meaningful standards as regards fresh air ventilation could, even by conservative estimates, be on the order of several billion dollars annually, far in excess of any anticipated cost for correcting the problem.

There is a near total absence of any meaningful health and safety regulations concerning the health and safety of several hundred million air travelers and tens of thousands of airline employees. Also, since we have for years set the standard worldwide, several hundred million air travelers annually in foreign countries are also affected due to the apparently deficient U.S. standards, expertise, and products in these areas.

The serious need for studies, as called for in the bill, as well as the establishment of standards and regulations concerning what is already known should be obvious at this point.

[The statement follows:]

STATEMENT OF BERTIL WERJEFELT, PESIDENT, XENEX CORP.

I am Bertil Werjefelt, President of Xenex Corporation, an organization involved in basic proprietary research and development work in energy conversion systems. Our research ranges from the essoteric areas of nuclear, electomagnetic and photocatalytic systems, to the more ordinary energy conversion systems as can be found on aircraft for pressurization, ventilation and controlling contaminants such as ozone.

I have been requested to appear before the aviation subcommittee today to provide testimony to this committee and the Senate on the issues of aircraft cabin air quality, the essence of Senate Bill S. 1770. Senate Bill S. 1770 calls for studies to be conducted to determine, among other things, whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are non-discriminatory and at least in conformance and parity with non-aviation standards, practices and regulations, and defacto circumstances, all concerning "air quality" and the protection of passengers and crew against uncontrolled hazardous

airborne contaminants on board civil aircraft carrying passengers. (Exh. 1) [1] I thank you for the opportunity to present this testimony.

Although it sounds simple and straightforward, the terminology: "Air quality on board aircraft" deserves elaboration so that the issues of this Senate Bill are clearly understood by all. First of all, air quality concerns the quantity, toxicity and contagiousness of suspended particulate matter, micro-organisms, moisture and gas in the air as well as the pressure of the air and, whether these are kept within acceptable health and safety limits. For instance, if the air pressure becomes too low the reduced levels of oxygen can be fatal or debilitating or if the contamination levels are too high, likewise the effects can be lethal or harmful. Secondly, the Bill concerns two broad air quality categories, the air quality during normal aircraft operations, and the air quality during abnormal operations, such as when there is an emergency of an in-flight fire generating smoke and toxic fumes in the aircraft, or cargo or luggage that is leaking toxic fumes into passenger and crew compartments.

I fully support the intent and the objectives of Senate Bill S. 1770. Studies in the areas called for by Senator Inouye's Bill are, in some cases, several decades overdue. Not only that, meaningful regulations and standards and practices are presently virtally non-existing and also overdue by several decades.

Some of the serious issues that will be revealed in this testimony were brought to the attention of the FAA a few years ago, some of them more than a decade ago; others three decades ago. Yet, constructive and positive action from the FAA has been slow to nil. As recently as two years ago we brought these matters to the attention of the FAA in the form of a petition for rulemaking (Exh. 2) (FAA Docket 20351) where, among other things, the FAA was asked to establish minimum standards of fresh air ventilation for passengers and cabin crew on board aircraft. We were promised by the FAA that it would address the serious issues of toxic fume protection for passengers and crew (Exh. 3), also under the framework of our petition for rulemaking. Our petition was denied and not even a word was mentioned of the toxic fume issue. In fact, even some testimony that we, and others, provided prior to the legal deadline was ignored by the Administrator of the FAA (Exh. 4). In addition, rebuttal testimony that we provided at the urging of the FAA and which we were assured would be considered prior to rendering a verdict on the petition was, in fact, totally ignored by the Administrator in his denial of the petition (Exh. 5).

Needless to say, we are dismayed at the autocratic arrogance and incompetence that we feel the FAA has displayed. However, on the more positive side, we sense a grass-roots support in contradiction of management and in favor of the establishment of standards and regulations in the areas that this Senate Bill addresses. This should come as no surprise. After all, it does not require much reflection to realize that we are all, at one time or another, passengers on board aircraft. Passengers on board aircraft include senators, congressmen, pilots, airline crews, FAA personnel, aircraft industry personnel, even management of giant industries using corporate jets. This Senate Bill is not directed to some small forlorn or forgotten segment of our society. It addresses the health and welfare of people from all segments of our society. The U.S. Air Transport Industry had approximately 300 million passengers annually that are affected. Worldwide, the Air Transport Industries transport approximately 1 billion passengers annually. This country has to date provided most of the equipment and the expertise to permit these industries to grow to their present stature. Regretably, this leadership role is now faultering.

It is my hope that the studies called for in Senate Bill S. 1770 will be conducted as soon as possible so that meaningful standards, and regulations if necessary, can be established to serve as to helpful step in the effort to preserve and enhance one of our cornerstones of U.S. industry-Aviation.

Senate Bill S. 1770 calls for studies to be conducted. The need for a study presumes that there are questions and answers to be made. Where irregularities occur in the answers, one must, of course, ask WHY and see further answers. In an effort to assist this committee and the Senate, I will now provide in my testimony what I consider the tip of the iceberg of these questions and answers along with some relevant commentary. Since these matters concern a broad spectrum of people, numbering in the 100 millions, most of whom are not technically or legally versed in these matters, but nevertheless deservant the respect of information that can easily be interpreted, I am presenting my testimony in a simple, straightforward and understandable format, devoid of technical or legal jarjon wherever possible.

Question. Is the oxygen content of the air on board aircraft, in many cases, only 80 percent or less of what one normally has at sea level?

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[1] The exhibits referred to in this statement have been retained in the committee files.

Answer. Yes. This is due to the reduced pressure in the aircraft cabin from that of sea level. By way of information, normal air pressure at sea level is 14.7 pounds per square inch (absolute). At normal cruising altitudes, the air pressure outside the aircraft may only be approximately 3 pounds per square inch (absolute). This is not enough air pressure to sustain life. The aircraft cabin is, therefore, pressurized to between 11 and 12 pounds per square inch (absolute). The difference in pressures between the aircraft cabin and sea level accounts for the difference in the amount of oxygen available in the air we breath on board an aircraft. What are the effects on passengers and crew of this low pressure?

Question. Have there been reports of respiratory illness due to poor fresh air ventilation or recirculation of cabin air?

Answer. Yes. It started three decades ago.

As early as 1952 flight crews complained about the discomfort of the dry cabin air, the increasing incidents of colds and the debilitating effects of smoke and odors resulting from recirculation of cabin air into the flight station. Subsequently, the flight stations have been supplied with 100 percent fresh air. (See Exh. 4 sub-exh. A, Page 2, Note 1.)

Question. Have there been reports indicating that the aircraft cabin air is causing ill effects among passengers and crew?

Answer. Yes. Ozone contamination, for instance, is one well-known problem which is still not adequately nor equitably resolved in the interest of health and safety of passengers and crew. Voluminous material is available through the FAA and unions concerning this matter. Eye problems of a rather severe nature have been reported. (See Exh. 4 sub-exh. G, a report at an Aviation Medical Seminar at Jacksonhole, Wyoming, May/June 1980, sponsored by the FAA, presented by Dr. Philip M. Corboy, Senior Aviation Medical Examiner, Honolulu, Hawaii.)

Also, a flight attendant report concerning breathing problems on a transcontinental flight from New York to San Francisco notes some serious problems with the cabin crew and the necessity to use oxygen intermittently and the notation by the flight attendant that "most (passengers) slept the whole trip (which seemed a bit odd for a day trip cross-country)". (See Exh. 6.) This is just one report of countless that have been made.

Question. Is it possible that contageous diseases are being spread on airlines?

Answer. Yes. This is obvious from the previous notation wherein the flight station required 100 percent fresh air in an effort to reduce the spread of contageous respiratory diseases. (See Exh. 4 sub-exh. A, Page 3, Note 1.)

In addition, in response to an obscure article in a Honolulu newspaper, a traveler from the United States East Coast notes that he contracted chickenpox on board a flight and subsequently passed the disease on to his wife. (See Exh. 7.) How prevalent is this? How many people are really affected? What studies have been or should be conducted?

Question. What is the cost to the traveling public and industry for poor ventilation?

Answer. The figure could easily be several billion dollars by a conservative estimate. If only 5 percent of the 300 million air travelers in this country are affected, causing work absence of only 2–3 days, simple arithmetic will demonstrate that the effects can cause losses to the rest of U.S. industry and the public on the order of several hundred million man-hours, amounting to several billion dollars annually. (See Exh. 8.)

Question. As it concerns fresh air ventilation, are the health and safety reasons equally important to all occupants on board?

Answer. Yes. Obviously, the health of passengers, whether the passengers be the owners of the aircraft or common travelers, is equally important as to that of the pilots who are now provided 100 percent fresh air. After all, the travelers are paying the salaries of the pilots. Why should they be provided any less from a health standpoint. From a safety standpoint the fresh air ventilation is also equally important to all occupants on board. It is fallacy to believe, for instance that large fresh air ventilation rates for the purpose of smoke evacuation from a cockpit fire is necesary for the pilots to save the plane when, in fact, it is known that such smoke is irreversibly lethal in a matter of seconds. (See Exh. 9.) So fresh air ventilation for health and safety reasons are unquestionably equally important to all occupants on board, be they flight crew, cabin crew or passengers.

Question. Is there a difference in the amount of fresh air per person per minute provided the cockpit crew versus the cabin crew and passengers?

Answer. Yes. According to the previously mentioned petition for rulemaking and the comments therein provided, it is apparent that cockpit crew members are provided approximately 70 to 150 cubic feet of fresh air per minute per person (cfmp).

It is also noted that presently the occupants of the passenger compartment are only provided approximately 5 cfmp (see Exh. 10 for cockpit crew ventilation rates). (See Exh. 1 article by Philip Hilts, at the Washington Post entitled "Today's Skies Not So Friendly" for fresh air ventilation rates for passengers.)

Question. Is occupancy density on board many aircraft approximately 200 people per 1,000 square feet of floor area.

Answer. Yes. (See Exh. 10A).

Question. Are 200 people per 1,000 square feet of floor area an occupancy density that exceeds the anticipated occupancy rates in the non-aviation environment?

Answer. Yes. (See Exh. 10B.)

Question. What are fresh air requirements for such occupancy densities?

Answer. At least 35 cfmp. In the cockpit it is up to 150 cfmp. Why?

Question. Why are some passengers and cabin crew provided as little as 5–7 cfmp fresh air?

Answer. For economic reasons. On a transatlantic ticket, for instance, the economy price of which is approximately $600.00, the airlines can realize a savings of less than a dollar from each passengers by reducing the fresh air ventilation rates to these levels in the passenger cabin. In perspective this equates to approximately two-tenths of 1 percent of the cost of an economy ticket. Paradoxically, the airlines can seemingly, at will, juggle the price of tickets by several hundred dollars.

Question. Why shouldn't all occupants on board be provided an equal amount of fresh air?

Answer. In our opinion, there is no valid reason for not doing so.

Question. Are there any regulations in the operating rules of the FAA regulations providing for a specified minimum of fresh air ventilation from a health and safety standpoint for passengers?

Answer. No. In light of the foregoing, it would certainly be prudent to provide such regulations in the interest of public health and safety.

Question. What is the cost for fresh air ventilation?

Answer. As stated previously in many cases the cost is approximately two-tenths of 1 percent of the cost of an average economy ticket. Based on the health standards that are established in the industrialized nations of the western world, it is taken for granted by most people that the cost for providing safe and healthy quantities of fresh air is included in the price of the ticket. In this case it does not appear to be so.

Question. Is fifty percent to ninety-five percent of the moisture in the air on board many aircraft sweat and breath from the occupants on board?

Answer. Yes. Unfortunately, this is true and given the uniqueness of the aircraft environment, this is a circumstance that is essentially unparalleled in any other environment a person is likely to encounter. Given the current poor fresh air ventilation practices, this moisture, in some cases, may be only exchanged a few times an hour in the passenger cabin of an aircraft. In contrast, cockpit air, in most cases, is exchanged as often as once a minute. The formula provided in Exh. 4, sub-exh. A, Page 4, is one method of verifying that up to 95 percent of the moisture in the air on board many aircraft is sweat and breath from the occupants on board.

Question. Do carbon monoxide, carbon dioxide and ozone levels on board some aircraft exceed the allowable limits in the non-aviation environment?

Answer. Yes. I have personally verified this.

Question. Is there inexpensive equipment available to test for suspected contaminants on board aircraft?

Answer. Yes. There is inexpensive equipment available to test for suspected contaminants on board aircraft. One very common method in the non-aviation environment is the use of "Draeger Tubes". This is a small hand-held pump, that literally anybody can operate, which pumps the air through chemicals in a glass vial. Depending on the amount of contaminants or undesirable gases, a reaction is produced that shows up on a scale on the vial. The approx. cost for the equipment is on the order of $150 and each test for, for instance, carbon dioxide, carbon monoxide or ozone costs approx. $2. This $2 cost is included in the cost of the vial.

Question. Does it require special skill or training to operate such equipment?

Answer. No. Anyone could learn this procedure in a few minutes.

Question. How much does such equipment weigh?

Answer. Approximately one pound.

Question. Are there safety reasons for providing large quantities of fresh air to cockpit crew members?

Answer. Yes. One of the principle reasons, from a safety standpoint, is to be able to evacuate smoke from the cockpit in the event of fire and to be able to do so within safe pressurization limits. Unfortunately, in many cases, this smoke is

vented into the passenger cabin. The capacity for smoke evacuation from the passenger cabin is, in many cases, only 3–5 percent of that of the aircraft cockpit.

Question. What are some of the contaminants that can be encountered during in-flight fires and toxic fume emissions from such fires?

Answer. Hydrogen fluoride, hydrogen cyanide, nitrogen dioxide, sulphur dioxide, hydrogen chloride, carbon monoxide, carbon dioxide. By way of example, hydrogen cyanide and hydrogen fluoride in even small concentrations are extremely lethal. Hydrogen cyanide, for instance, is used in gas chambers for execution purposes.

Question. Are some toxic fumes from aircraft fires irreversibly lethal in a matter of seconds?

Answer. Yes. This is a well-known fact among experts. (See Exh. 9.)

Question. Is there any protection for smoke and toxic fumes for the cockpit crew?

Answer. Yes. Their oxygen masks also function as smoke masks.

Question. How much smoke and toxic fume protection is provided for the cockpit crew?

Answer. Approximately 15 minutes, according to FAA regulations.

Question. How much toxic fume protection is provided for all the cabin crew?

Answer. By regulation, none. On some foreign carriers cabin crews are provided 10 to 15 minutes of toxic fume protective breathing capabilities. In some cases, there is limited protection for cabin crew on U.S. air carriers but this is the exception rather than the rule.

Question. Is 15 minutes determined to be enough protection in the event of toxic fumes or fires encountered in flight?

Answer. No. Not even 20 minutes is determined to be enough according to statement made by an airline representative at the SAFE Symposium as recently as December 1981. This is simple to surmise inasmuch as some aircraft are flying at an altitude of approximately 40,000 feet. It is not likely that, for instance, a jumbo jetliner could even be on the ground at a suitable emergency landing site and evacuated within 15 minutes.

Given the practical aspects, it has been repeatedly demonstrated that much valuable time is lost in an attempt to determine the extent or origin of a fire, during which time toxic contaminants are accumulating in the aircraft cabin.

Let it not be forgotten that these contaminants are lethal in a matter of seconds or minutes.

Question. Are there any instructions on board aircraft for the passengers of what to do in the event of an in-flight fire or smoke emergency?

Answer. No. None at all and there are none required by any regulations, standards or practices that I have heard of. This is in sharp contrast to any hotel that the same passenger traveling on the airlines would be visiting. It is noteworthy to consider that at 40,000 feet there is no way out of such a dilema. You are captive. There is no fire staircase, fire department with ladders, rooftop rescue by helicopter, no windows to open, etc. etc.

Question. Are the contents of some fire extinguishers lethal?

Answer. Yes. This is common knowledge among experts. It is an unfortunate fact that, especially in the aircraft cabin environment, the same components that may be helpful in extinguishing a fire may also extinguish life.

Question. Are the passengers' oxygen masks useful for smoke and toxic fume protection?

Answer. No. (See Exh. 11.)

This is a common misconception not only by airline passengers but cabin crews, cockpit crews and even FAA personnel. The oxygen masks are totally useless for smoke and toxic fume protection and, in most cases, would possibly not even be deployed, not for the sake of the hazards that the oxygen would contribute to a potential fire, the small amount of oxygen available would do very little to fuel a fire. I will take the liberty to quote Exh. 11 in its entirety: "It is not recommended that the passenger oxygen masks be deployed when excessive smoke is in the passenger cabin. The passenger oxygen masks are not smoke masks and were not designed, tested or certified to serve this purpose. These masks supply a breathing mixture which consists primarily of cabin air, admitted through an inlet valve in each mask, and a relatively small amount of pure oxygen from the cabin oxygen distribution manifold. Thus, in a smoke-filled cabin, any noxious fumes would be inspired directly into the passenger oxygen masks, and the small amount of manifold oxygen present would provide no significant displacement or dilution of toxic agents." This is a quote from a manual for pilots instructing them what to do in the event of smoke or fire emergencies.

Question. In a recent 18 to 20 month period, have more than 600 people been esphyxiated on board aircraft?

Answer. Yes. In one seemingly survivable accident alone, where the aircraft landed intact on a runway, 300 people, among them 11 Americans, were asphyxiated. In comparison to the infamous MGM hotel fire, where there were 68 asphyxiation fatalities, it appears the aviation industry is confronted with the equivalent of an MGM disaster every few months, in terms of asphyxiation fatalites. (See Exh. 9.)

Question. Is there any respiratory protection for passengers against lethal fire extinguishing agents?

Answer. No.

Question. What is the cost for meaningful smoke and toxic fume protection for passengers and crew?

Answer. Within the current state of the art, providing a minimum of one hour of toxic fume protection has been estimated by one airline to cost less than 2¢ per ticketed passenger. The direct cost will vary depending on the type of operations of the individual airlines. Nevertheless, it is clear that the cost would be approximately one-tenth of 1 percent of the cost of the ticket.

Question. Is the altitude equivalent air pressure on board an aircraft as low as the equivalent of 8,000 to 9,000 feet altitude?

Answer. Yes. It is commonly believed and oftentimes the case that cabin pressure is approximately the equivalent of 5,000 to 6,000 feet altitude. However, it is not unusual for it to be 7,000, 8,000 or 9,000 feet. What should the pressure be? What is safe? What is dangerous?

Question. Is it possible that jet lag can be caused by the detrimental environment on board aircraft?

Answer. Yes. In sub-exh. A, Page 2, Note 2 this possibility is raised. Considering the fact that as far as the heart is concerned, even though a person may be sitting still for five hours on a transcontinental flight, the heart may be doing the equivalent work of rapid walking or slow jogging in order to pump sufficient oxygenated blood to the various parts of the body. Add to this the fact that the immunological system in the respiratory tract is working overtime contending with excess levels of micro-organisms and other contaminants and that the body is being dehydrated by low humidity, it would certainly appear even from a cursory standpoint that these few factors alone would contibute to fatigue, exhaustion and jet lag.

Question. Is the heart beat increased during flight?

Answer. Yes. Due to low pressure and low oxygen content of the air on board. As just mentioned, this is true depending on the physicial health of the individual. The rate of increase may vary substantially between individuals. Can this be dangerous? Yes.

Question. Has the American Medical Association warned its members of the ill effects of air travel on persons with certain cardiac and respiratory ailments?

Answer. Yes. (See Exh. 12.)

Question. Has a study been conducted which indicates that on a percentile basis, between 6 and 7 out of every 100 air travelers with recent heart trauma, die within 3 or 4 days of air travel?

Answer. Yes. Regretably. (See Exh. 13, Page 75, Note 1.)

What is being done about this by the FAA?

There is a need for more studies—obviously, they are long overdue.

Question. The foregoing question and some points made in Exhibit 13 certainly raise the question of whether or not there any medical kits and appropriate training of the cabin crew to deal with common medical problems, let alone heart attacks. Are there, in fact, appropriate medical supplies and trained personnel on board aircraft?

Answer. This matter should be examined. What equipment would be suitable? What medicines, What type of training is required? Obviously questions that deserve study and answers. As pointed out in the study (Exh. 13) there isn't even appropriate equipment at the airport referred to in the study. How many other airports are in a similar deficient circumstance?

Question. It appears to be the objective of the FAA to make aircraft fireproof. Even if this were possible, what about the luggage and the cargo? Can this be fireproofed and leakproofed?

Answer. No. I wili quote from Exh. 15 "In one, for example, hydrochloric acid that had been packed in a tile company employee's checked luggage leaked. It was discovered when the resultant smoke was seen coming from the baggage compartment. In another, an employee of a rocket manufacturing company packed live rockets in his suitcase and checked it through to his destination—a government firing range."

Question. This would lead us to the problem of current methods of hijacking aircraft, which, rather than by firearms, now is accomplished by the threat of the use

of flammalbe fluids. Would it not be appropriate to provide smoke and fire protection for the passengers and crew in light of these developments? And would it not be suitable that all aircraft be equipped with the best fire extinguishing means to cope with such incendiary devices?

Answer. I think the answer is obviously yes, especially when the cost for so doing is nearly insignificant., What is being done?

Question. In 1976 there was an FAA industry meeting concerning smoke masks for passengers. (See Exh. 17.) The need for toxic fume protection for passengers was certainly recognized but what has happened since? Where is the toxic fume protective breathing equipment?

Answer. Certainly not on the airplanes because I haven't seen any. In a recent news article in Aviation Week and Space Technology (Exh. 18) it is noted that the FAA is hoping that industry will, due to the low cost of improved breathing equipment, adopt this voluntarily. We certainly hope so too. Nevertheless, it would appear prudent to put a deadline on the matter or perhaps more formally advise and encourage industry to provide this improved protective breathing equipment.

Question. As it concerns a recent effort by the FAA to cope with the ozone problem by means of regulations, it appears to me that they are ineffective and I will discuss this further in a moment. Meanwhile, I would like to call the following question to the attention of this committee and this concerns the interpretation of the current regulation on ozone which is in the operating rules of the FAA regulations Par. 121.220. This paragraph is under sub-part J Special Airworthiness Requirements of the Federal Aviation regulations.

Paragraphs 121.211 and 121.213 contain some caveats which would imply that the newly enacted ozone rule 121.220 does not apply to virtually any current modern day jetliner because Par. 121.213 appears to exempt all aircraft certificated under Part 25 from Par. 121.215 thru 121.283. Virtually all aircraft flying today are certificated under Part 25. So, what is the correct interpretation of the law as it currently stands?

Question. What is an on-ground ozone retention test?

Answer. This is a test to determine the percentage of ozone that is retained within the cabin of an airplane after ozone is drawn into the cabin with the normal ventilation air. For convenience these tests are conducted on the ground. Ozone is fed into the ventilation system at a known concentration and the concentration in the cabin is measured. Since ozone is somewhat unstable and will termally decompose over long time periods, a fraction of it is destroyed by the various surfaces (seats, floors, walls, etc.) in the airplane. The fraction of ozone that remains in the cabin is called the retention factor. This is used by airlines in combination with other data to determine whether ozone converters are needed on their aircraft to meet FAA regulations. This information is widely known by the FAA, aircraft manufacturers and airlines.

Question. What is the duration of the on-ground ozone retention tests that are conducted by aircraft manufacturers.

Answer. Several hours. FAA people are probably aware of the duration of these tests.

Question. What is the effect of running on ground ozone retention tests for short time durations and/or on newly refurbished airplanes.

Answer. When first exposed to ozone many materials have the capability of decomposing ozone by converting it to normal oxygen, but most materials rapidly lose this ability within approximately 24 hours of exposure. Therefore, if an on ground ozone retention test does not have a duration of more than approximately 24 hours, or until the material inside the airplane such as seats, carpets, plastic walls, etc. stabilize to the point where they no longer decompose ozone, unrealistically low ozone retention figures are produced. More accurate test results would be achieved if the tests were done in an airplane that had been in high altitude service in the springtime when ozone is normally present in the atmosphere at normal flight altitudes in the northern hemisphere. The new materials rapidly decompose ozone at a much faster rate than typical used or older materials. The above may or may not be known by FAA personnel but they could readily obtain this information from the aircraft manufacturers. It is widely known and should be recognized that most materials can initially decompose ozone but rapidly lose this ability (Exh. 19 Page 8, IV B1). Only specially formulated and designed catalysts retain this ability over a long period of time.

Question. How should on ground ozone retention tests be performed to insure results that closely duplicate conditions that will exist in actual flight?

Answer. The tests should be conducted on airplanes that have not been newly refurbished. The final measurements should also be made only after conditions stabi-

lize in the airplane. That is after the ozone decomposition rate stays steady for several hours.

The above recommendation is based on the answers to the previous questions and the results of laboratory tests (Exh. 19) which demonstrate that even water with organics contained therein will not retain ozone after limited exposure. Water and organic matter are the most effective components known to reduce ozone at or near room temperatures.

The preceding questions, answers and commentary, in plain language and simple terms, only scratches the surface of Senator Inouye's Bill. It is appropriate to summarize and put the preceding testimony in perspective to legal aspects and commonsense. As it concerns fresh air ventilation for health and safety purposes, my testimony shows, without a doubt, that, in the face of known and recognized health and safety hazards, pilots are provided as much as 150 cubic feet of fresh air per minute per person (cfmp) while at the same time the cabin crew and passengers who face the same health and safety hazards as the cockpit crew are provided approximately only 5 cfmp. Also, in the face of well documented lethal hazards and alarming statistics of fatalities it is also evident from the testimony that while pilots are given respiratory protection against the known hazards of toxic fumes, passengers are not even provided any instructions of what to do in such circumstances, let alone any respiratory protection whatsoever, neither are the cabin crew, in many cases, provided any protection. In addition, it is recognized in industry that the protection provided for the cockpit crew, in the light of unfortunate and sad experiences, is inadequate.

Safety equipment is provided in the unlikely event of ditchings at sea or sudden cabin decompression. For this purpose oxygen masks and life vests are provided to passengers on board aircraft. Ditchings at sea and decompressions are far more uncommon than aircraft smoke and fire, yet there is no protection. This unfortunate fact is well known by the FAA.

The circumstances that are apparent in aviation based on my testimony are unthinkable from a legal as well as moral standpoint in the non-aviation environment. For instance, comparing the pilots to the manager and immediate staff in a hotel. Would, for instance, the owners of a hotel condone the philosophy that the manager and his staff be provided fire extinguishers, smoke alarms, smokehoods, the phone number to the fire department, description of fire escape routes, while at the same time none of this was provided to the owners nor the guests of the hotel? Of course not.

In many cases, by law, it is a requirement to provide smoke alarms and instructions and exit signs denoting emergency escape routes etc. for all occupants of a hotel, not just the manager.

I would like to site another simple but striking example. Presume a construction job site where there are some known respiratory hazards and the risk of falling objects. It is common knowledge, and in many countries a legal requirement, that workers at the site be provided protection. Under the circumstances would one, for instance, provide hard hats and protective breathing equipment for only 3 of the workers and none for the other 10, and nothing for the visitors to the job sight? Of course not. It is a preposterous suggestion. Yet, this is what is happening in aviation.

In many cases the law of the land supersedes the local federal aviation regulations. This is now apparent in some countries that have opted for additional toxic fume protection on board their passenger carrying aircraft. Should we allow ourselves to be substandard and deficient in such serious aviation safety matters? Of course not.

I believe I have made my point with the simple questions, answers, commentary and the analogous examples I just gave. However, I should caution the members of this committee and the Senate that all the problems that need to be studied and resolved as a consequence of the Senate Bill are not as simple, blatant and easy as the ones brought to light in this testimony. Considerable expertise and careful study over a long period of time will be required to resolve the problems in the more obscure but yet important scientific, medical and technical areas. Based on my testimony, it is my hope that the obvious deficiencies will be dealt with swiftly and resolutely, and the others with patience and perseverence.

This testimony is not intended to alarm the traveling public I stress this. It is given at the request of this committee in order to accomplish positive change and improvement in areas of aviation health and safety that previously have been neglected. Meaningful corrections based on this testimony and subsequent studies are for the betterment of the entire industry and the health and welfare of a large segment of our society. I ask those who are privy to this and subsequent information to

treat same with discretion so that meaningful changes can be accomplished with the least amount of adversity.

Madame Chairman, the literature available in support of studies as requested by this Bill and improved regulations and standards could number several thousand pages. We alone could submit a thousand of them. However, I believe the preceding testimony more than adequately attests to the need for studies as called for by Senator Inouye's Bill S. 1770, not only that, but swift and affirmative action on what is already known.

I thank you for the opportunity to present this testimony and for being of service to this committee and the Senate.

Mr. WERJEFELT. Now, this summarizes my prepared statement. I would like to, if I may, comment on some of the information that was previously given by the FAA which appeared to be quite erroneous, and I will do so briefly.

The FAA and others are relying on a denial of petition for rulemaking which was issued approximately 15 months ago by the Acting Administrator of the FAA. The denial is so erroneous that it does not even quote existing law correctly, implying, and I will quote here, "the current rule requires for each crewmember a minimum of 10 cubic feet per minute of fresh air plus additional ventilation." This is from the Acting Administrator of the FAA. There is no such rule. There is only a rule for cockpit crewmembers, nobody else. This is only one of several erroneous statements in the denial which the FAA and the industry is relying on in opposing S. 1770.

As regards the comments on humidification that were expanded on by Mr. Beard of the FAA, I should like to advise everybody that British Airways has for 20 years humidified their aircraft. There is no problem with——

Senator INOUYE. At what level?

Mr. WERJEFELT. At 20 to 25 percent, Senator.

And most recently, Lockheed has developed some very efficient equipment for humidifying their L–1011's. The argument advanced by the FAA would imply that you should not have any aircraft in Hawaii, for instance. Humidities there are 80 percent, and when airplanes are parked it would pose a serious problem. That is not true. There are no corrosion problems on the order of what they are advancing.

The FAA cited a medical study which indicated that there is no need for humidification, there is no medical reason for it. The study that they cite I have previously apprised them of as being erroneous as regards aircraft environment, and the doctors who made the study indicated this themselves. The subjects that were tested were provided, as I recall, 78 cubic feet of fresh air per person per minute, totally sterilized humidification at 10 percent. It is known that if there are no contaminants in the air, low humidification is certainly less harmful but to imply, as they do, that there is no need for humidification for the proper functioning of the immunological systems, et cetera, is absurd.

I believe it would be appropriate to find out what the smoke tests are that they mentioned that they were going to make in the 707 fuselage, whether or not these would be made at the decompressed atmospheres that are common during jet flight.

Now, we have heard testimony here that a heart attack on board an airline is considered not to be an illness caused by flight. I think

any testimony from anywhere in the medical community will attest to the contrary, but this seemed to be the idea advanced by the FAA.

It is also said that there are pressurization problems with high ventilation rates. Looking into the matter from a technological standpoint, they will find that there are no such problems.

As regards the reduced ventilation rates by turning off the air pacs, the difference in costs to us travelers on a transatlantic ticket which is valued at $600 in economy is on the order of 50 cents—a very small amount.

I would certainly challenge the mention here that the air quality on board an airliner is better than what it is in this room. It is demonstrated that 95 percent, in many cases, of the moisture on board an airliner is sweat and breath, and I do not for a second believe that to be the case here.

That would conclude my testimony.

Senator INOUYE [presiding]. You have indicated that the British have been providing for 20 to 25 percent humidity in their aircraft for the past 20 years.

Mr. WERJEFELT. For the past 20 years.

Senator INOUYE. Have they encountered problems with the system as indicated by the FAA?

Mr. WERJEFELT. Previously there were problems.

Senator INOUYE. Corrosion, et cetera?

Mr. WERJEFELT. No. In the cases where corrosion has been apparent, it has been due to an absence of appropriate maintenance attention.

Senator INOUYE. What has been the additional cost to the British?

Mr. WERJEFELT. The cost, Senator, is relative to the amount of moisture that is being provided, the specific amount of moisture. I believe the British have used their humidification system on 3-hour flights or longer, and they tapped the onboard supply of potable water. The direct cost of so doing is somewhat difficult to define inasmuch as you always carry a little extra drinking water in other words, more drinking water than what you need for an entire flight.

The system, due to the old technology, the old state of the art, is cost intensive and therefore is used intermittently during the flight.

Senator INOUYE. You have indicated that it would cost an extra 50 cents per passenger?

Mr. WERJEFELT. For humidification?

Senator INOUYE. Yes.

Mr. WERJEFELT. I think it would be less than that.

Senator INOUYE. Where did you get those numbers?

Mr. WERJEFELT. From the airlines, but the 50 cents that I mentioned previously relates to the reduced fresh air ventilation rate—the rates that previously were about 20 or 22 cubic feet of fresh air per person per minute. Reducing it to 5 cubic feet saves the airlines 50 cents per ticketed passenger on their transatlantic flight. On a shorter flight we are talking nickels and dimes.

Senator INOUYE. Do you suggest 50 cubic feet per minute per passenger?

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Mr. WERJEFELT. Senator, that figure is derived from—it is a conservative figure based upon occupancy densities on board aircraft as compared to the nonaviation environment. The purpose of this bill is to investigate what are the appropriate ventilation rates. It would appear at this point that 50 cubic feet is a most appropriate minimum inasmuch as a cockpit crewmember gets up to 150, and more in some cases.

Senator INOUYE. Is the cost cited—of $633 million for the 727 fleet and $1.3 billion for the 747 fleet—does that sound correct to you?

Mr. WERJEFELT. No, sir. I pointed this out to the FAA at the time. The costs that had been estimated—for instance, the cost of fuel is grossly inflated to begin with. The current state-of-the-art technology has not even been investigated by the people who commented and provided those figures. I think it is possible that 40 to 50 cubic feet of fresh air could be provided at an additional cost, again, on a ticket at something on the order of 20 cents.

Senator INOUYE. Senator Goldwater.

Senator GOLDWATER. I just had one question, and I think probably Mr. Reese, from your position, I think you have some engineering background?

Mr. REESE. Yes, Senator, I have.

Senator GOLDWATER. It is possible now for the flight engineer to control the temperature in the cabin.

Would it be terribly expensive to provide a cabin indicating instrument to show ozone, humidity and temperature so that they could be kept at a predetermined value?

Mr. REESE. Senator, I am not qualified to respond to that directly. I would like to respond for the record, if I may.

[The following information was subsequently received for the record:]

In contrast to temperature, which is readily monitored and automatically controlled, measurements of ozone and humidity are not simple or easy to make. Available ozone monitors use ultra violet absorption, chemiluminenscence or oxidation-reduction reactions and are basically laboratory techniques requiring expensive equipment, reacting gases, or exact chemical solutions. None of the techniques is currently suitable for unattended monitoring on board aircraft. Humidity monitoring, although basically simpler, is still difficult because of the unusually wide range of humidity encountered in aircraft and because available instruments have not been designed for aircraft use. In both cases, extensive development programs would be required.

These would be of little advantage in monitoring ozone and humidity. Current regulations limit ozone concentrations to peak levels below 0.25 parts per million (ppm), and time weighted averages below 0.1 ppm for flights over four hours. No crew action is necessary on airplanes equipped with ozone filters. If an aircraft is not equipped to remove high altitude ozone, then for the few instances where ozone may be encountered, the flight crew can request a lower cruise altitude prior to dispatch. Weather reports can indicate where a lowering of the altitude of tropopause occurs and where high concentrations of ozone are apt to be encountered.

Humidity levels are dependent only on the passenger load factor and cabin ventilation, and at cruise are not affected significantly by flight altitude or ambient temperatures. Thus the crew has very few options to control humidity.

Senator GOLDWATER. Mr. Collier, do you feel you could answer that?

Mr. COLLIER. May I ask Mr. Spannuth of TWA if he might have some helpful information on that?

Mr. SPANNUTH. With respect to ozone, to my knowledge, there is no equipment that can measure that on board in any reliable way. It would take some scientific instruments that would probably require engineering or science types to monitor.

With respect to humidity, yes, that could probably be monitored, but I do not know what the flight engineer could do about it, maybe air recirculation if the airplane is equipped to do that.

Senator GOLDWATER. I think, are not ozone quantities measured on the ground in most cases for possibly an hour? Is that not true?

Mr. SPANNUTH. I am not sure I understand what you are saying. Ozone problems I guess in places like Los Angeles and New York City would be an ambient situation, but it occurs on an airplane. The problem is at altitude in high latitudes during certain seasons of the year.

Senator GOLDWATER. I realize that ozone is a very difficult thing to measure, and I also realize that anything like clothing or anything that it comes in contact with deteriorates it. I was really looking for a possible solution for the crew to maintain the proper mixture. But I have my doubts that it could be done, other than humidity and temperature, which already can be measured.

Mr. SPANNUTH. We believe that the catalytic converters which are now carried in our high-altitude, long-range airplanes do the job, and there is no evidence to say that since those have been installed there have been any problems.

Senator GOLDWATER. You know, we did find out something quite by accident. In the new Lear jets, above 50,000 feet the heat turns the ozone into oxygen, and that is quite a remarkable discovery.

Mr. SPANNUTH. And recirculation can help reduce the ozone also.

Senator GOLDWATER. I have no further questions.

Senator INOUYE. If all you say is correct, that we are unable to test the level of ozone in flight, how can the FAA say that the ozone level is safe?

Mr. SPANNUTH. It can be detected. I was saying—I was responding to Senator Goldwater's comment about, is there a device that could be put on all airplanes for the pilot to monitor, and there is nothing available. But there are some scientific instruments that are carried on board and can check a given flight for ozone concentration, yes.

But you depend in many cases on airplanes of proper design and maintenance to insure, once the parameters have been established, that there is in this case less than the injurious amount of ozone.

Senator INOUYE. Are you aware of any monitoring carried out on aircraft?

Mr. SPANNUTH. No; I am not. We feel that the engineering data that put a certain size catalytic converter on the aircraft is accurate, and it complies with the Federal air regulations and we know of no problems with ozone as far as our passengers are concerned since those devices have been installed.

Mr. COLLIER. May I add to that answer, Senator Inouye? I do have in my files some correspondence from one of the airlines where they did monitor ozone on some of their flights. And of course, this answer does not include the well-known tests that were done by some airlines in conjunction with the FAA and the NASA

on some 747 flights in developing the catalytic converters for airplanes.

Senator INOUYE. As experts in this area of air quality for passengers, what are your thoughts on smoking in flight?

Mr. COLLIER. The issue of smoking, tobacco smoking in flight, is one that has been taken under the jurisdiction of the Civil Aeronautics Board, which is the board that oversees comfort questions, that is, passenger convenience. It has been treated as a matter of passenger comfort and not a matter of passenger health or safety.

As a matter of comfort, it is subject to the marketplace pressures, as other items of comfort are.

Senator INOUYE. Are you convinced that it is a comfort matter and not a health matter?

Mr. COLLIER. We have not seen anything other than what the results of smoking are in any other place beside an airplane. There is no unique relationship, that we are aware of, between smoking and health on airplanes, that does not apply anywhere else.

Senator INOUYE. The Surgeon General's warning is not to be considered?

Mr. COLLIER. It is not to be considered as a matter unique to aircraft flying.

Senator INOUYE. Do you really believe that the sample of cabin air taken from an airplane at National or Dulles or from an airplane flying over the city would have lower contaminants than samples taken from this room?

Mr. COLLIER. That was the testimony of the AIA. We cannot support that with any facts, but it sounds reasonable.

Senator INOUYE. Do you really believe that, Mr. Reese?

Mr. REESE. Yes, Senator.

Senator INOUYE. Then we had better do something about this room.

Do you believe that air quality has anything to do with the so-called problem of jet lag, which incidentally is costing industry billions of dollars because of personnel not being able to operate at a high level of efficiency?

Mr. REESE. Senator, I think your question is one of a medical nature that I would not be qualified to discuss.

Senator INOUYE. Do you think this matter should be investigated or studied?

Mr. REESE. Well, again, I am not qualified to answer.

Senator INOUYE. Are you aware of any definitive studies made on the effect of air quality on jet lag?

Mr. REESE. No, Senator, I am not.

Senator INOUYE. Then if jet lag is a cause of the loss of billions of dollars to industry, do you not think it is worthy of an investigation by some agency?

Mr. REESE. That may be true, Senator, but I think the question we were considering here is the question of air quality in an aircraft cabin compared to other nonaviation environments.

Senator INOUYE. But do you think that it might be worthy of studying, the effect of air quality on jet lag?

Mr. REESE. I cannot answer that question.

Senator INOUYE. You see, I am not a physician, so I do not know what causes my type of jet lag. I am a bit fortunate. I can go back

to work in 24 hours. But most of my colleagues tell me that even a flight from California to the east coast is sufficiently devastating for them to be out of commission for a couple of days. And I am able to fly directly from Hawaii, which is double that, and maybe my system can take it.

I do not know what is causing this, air quality or nonsmoking or smoking. But I would like to see some study be made, whether it is ozone or contaminants. But you do not think it is worthy of study?

Mr. REESE. I did not understand S. 1770 to be addressed to that issue.

Senator INOUYE. It is just a study, is it not? It does not direct the FAA to regulate and direct airlines to carry out such practices.

Mr. REESE. Our position, Senator, was that the air quality in aircraft cabins is equal to or better than the air quality in other environments, both transportation and nontransportation. The relationship to jet lag I think is an entirely different question, which I am not knowledgeable enough to comment on.

Senator INOUYE. Your conclusion is that this bill is not required and it is redundant, and throughout your testimony you have indicated that sufficient studies have been made. That is your feeling?

Mr. REESE. As far as the quality of the air in the aircraft cabin, yes.

Senator INOUYE. Thank you very much.

Mr. WERJEFELT. Might I just add something to the air quality issue?

Senator INOUYE. Please do.

Mr. WERJEFELT. I have in my prepared statement tried to define air quality in simple, very simple terms. Air quality on board aircraft deserves elaboration so that the issues of the Senate bill are clearly understood by all.

First of all, air quality concerns the quantity, toxicity and contagiousness of suspended particulate matter, microorganisms, moisture and gas in the air, as well as the pressure of the air, and whether these are kept within acceptable health and safety limits. Air quality on the ground, as for instance, it concerns airpressure is a de facto circumstance. We are always confronted with the same pressure. This is not the case when flying. So I hope that is a clarification.

Senator INOUYE. Several Senators have indicated that they would like to submit questions, and if we may we would submit written questions for your response, if that is all right.

Senator INOUYE. Thank you very much.

We now have the health experts panel No. 1: Dr. Elliot Dick, professor, Department of Preventative Medicine, University of Wisconsin Medical School; and Dr. Charles Billings, associate professor of environmental health sciences, Johns Hopkins University School of Hygiene and Public Health.

Doctors, welcome. May I call upon you first, Dr. Dick?

STATEMENTS OF DR. ELLIOT DICK, PROFESSOR, DEPARTMENT OF PREVENTIVE MEDICINE, UNIVERSITY OF WISCONSIN MEDICAL SCHOOL; AND DR. CHARLES BILLINGS, ASSOCIATE PROFESSOR OF ENVIRONMENTAL HEALTH SCIENCES, JOHNS HOPKINS UNIVERSITY SCHOOL OF HYGIENE AND PUBLIC HEALTH

Dr. DICK. Thank you very much, Senator Inouye.

I might say in advance that I represent only the constituency which I serve as a member of the UW faculty, that is, the citizens of Wisconsin and of the 50 States. I understand that the president of the Xenex Corp. recommended that I come here. He talked to me briefly on the telephone. The first time I saw him was just now. He and I do not know one another at all, and my testimony is totally uninfluenced by him. Perhaps I shall meet him after this particular session.

I would like to have my testimony as written entered into the record.

Senator INOUYE. Without objection, so ordered.

Dr. DICK. I should like to comment upon some specific materials that were brought up:

Item 1. The air is not sterile in an aircraft cabin. It not as sterile as, in all likelihood, it is here in this room. I am a respiratory bacteriologist and virologist and have worked 25 years in this area. If one takes one of these Petri dishes which I have here on this table, which has a nutrient in it which grows bacteria and exposes, say, half a dozen of them around this room, you would probably get only one or two colonies per plate. By and large, the air of a rather unoccupied room of this sort is really very good.

In my search of the literature prior to coming out here, I looked for some data on contamination of an airplane cabin by bacteria. I found no citations. So I did an experiment on the Stretch 727 on which I flew from Chicago to here. My procedures were the following:

I divided up the test period into two times: one, the 40 minutes in which we were on the ground; and, two, the 70 minutes in which we were airborne. I exposed these Petri dishes underneath the vent on the seat next to me and in several other locations on the aircraft.

I might say that this was a crowded airplane with, at the most, a dozen empty seats in the entire tourist section of the Stretch 727. In the first 40 minutes, which is the period we sat in the airport before taking off, 30 colonies of bacteria which would grow at human body temperatures were found on that Petri dish which was exposed on the seat beside me.

This is doubtless a very conservative measure. The right way to do this is not to simply expose a plate but to suck a measured quantity of air into a broth. Doubtless I missed many bacteria. I would like to emphasize again that these organisms, that I incubated here in Washington last night, grew at body temperature and therefore are probably from human effluvia.

The cabin air while airborne was only slightly better. The flight took about 70 minutes, and about 30 colonies appeared on the plate. These were bacterial colonies derived from airborne bacteria. I also took a swab, just like you take a throat swab, from the ducts

leading to the seat. Very surprisingly, that specimen grew absolutely no organisms at all. Therefore it was not contributing, in all likelihood, to the bacteria which I found on my plate.

In brief the bacteria I found on my Petri plates were almost surely airborne. So the cabin air on my flight was not sterile. The experiment which I conducted was of the crudest type; it was not exhaustive at all. I firmly believe that a more systematic and planned experiment should be done. It can be done relatively inexpensively. It should be performed by an unbiased investigator.

Item 2. I investigated the literature thoroughly over the past 5 years and found only one documented outbreak of apparently airborne illness in an aircraft, but this outbreak was a lulu. It was in a 737 taking off from Homer, Alaska and bound for Kodiak, whose port engine failed on takeoff. There were no mishaps because of the engine failure. On that plane was a woman who was 1 of 53 passengers, and this woman was acutely ill with influenza (laboratory diagnosed). She spread her virus to 72 percent of the other individuals on that plane.

This was probably during the time the aircraft was delayed on the ground, but we do not know. Four people were hospitalized in that outbreak. It is extraordinarily fortunate that nobody died, because influenza kills people. It is a dangerous virus, particularly if anybody was there with a compromised pulmonary or cardiovascular system.

So we know that the air is not sterile. Two, we know that severe epidemics can occur. And I would urge this committee to investigate this more thoroughly, and that reputable and independent scientists be permitted to do that.

Thank you.

[The statement follows:]

STATEMENT OF ELLIOT C. DICK, PH. D., CHIEF, RESPIRATORY VIRUS RESEARCH LABORATORY, PROFESSOR, DEPARTMENT OF PREVENTIVE MEDICINE, UNIVERSITY OF WISCONSIN MEDICAL SCHOOL

I. INTRODUCTION—PROFESSIONAL HISTORY AND SUBJECT BACKGROUND

The speaker's research over the past 25 years has focussed chiefly on the epidemiology and transmission of the various respiratory viruses [1–5]. This time frame is synchronous with the period in which most of the respiratory viruses known today where discovered, including those causing the common cold. (It should be noted by The Aviation Subcommittee that colds, influenza and other similar respiratory ailments are caused by microbes—chiefly viruses—not by cold, fatigue, low himidity or the various other factors often cited as "cold-causing".) Approximately 150–200 viruses have been associated with respiratory ailments ranging in severity from a mild cold to a fatal pneumonia. Since so many microbial agents are involved and most of them are viruses, it has not been possible as yet to formulate broadly effective vaccines or antiviral chemotherapeutics. In fact, disinfection of the air we breathe is one of the few measures we have to control respiratory illnesses!

In this presenation, I shall omit discussion of airborne bacterial infections. Airborne bacteria are very important in certain special cases, e.g. tuberculosis, and in certain individuals who pulmonary passages are compromised, e.g. those with emphysema; however, the vast majority of infections which might afflict air travelers are virus-caused.

Most epidemiologists tracing chains of transmission generally separate the routes into two broad categories, contact and airborne. Contact transmission suggests direct movement of the causative microbe from person-to-person by actual physical contact, e.g. shaking hands, or by sequential handling of an inanimate object such as the handle of a flush tiolet. Contact transmission is probably most important in those upper respiratory infections characterized chiefly by a runny nose (rhinor-

rhea). It is postulated that many ordinary colds are disseminated by contact. This type of transmision is probably not dependent upon aircraft cabin air quality. Crucially related to aircraft cabin air quality is the airborne route. Airborne transmission is accomplished chiefly by infectious droplet nuclei less than five μm (micrometers; one μm=ca. 1/25,000 inch) in size. These small particles, often extruded during coughing, remain airborne for an extended time period and can pentrate deep within the lung of a recipient. There is also an airborne-like route of dissemination often termed "large particle aerosol" transmission. In this situation the particles are large enough (about 10–20 μm or greater in diameter) to fall from the air within a few feet and within a few minutes; when inhaled, these large particles are usually captured in the upper respiratory tract. Efficient aircraft ventilation could modify significantly dissemination of infection by large particle aerosols.

II. TRANSMISSION OF INFECTION WITHIN THE AIRCRAFT CABIN

There are very few reports of illness transmission in commercial aircraft. It is unlikely that the paucity of reports is a result of negative results from exhaustive studies of the subject. It is not easy to investigate. Since 1975, the speaker has flown often between Madison, Wis. and the National Science Foundation research base at McMurdo Station, Antarctica. I, like many others I suspect, have often speculated privately about the amount of intra-aircraft transmission which may occur on these long trans-Pacific flights. However, I have hesitated to propose an investigation on the subject, as the logistic hurdles seemed too great. Tracing illnesses in the large numbers of persons deplaning and emplaning at each stop seemed a more complex project than could be carried on by a scientist working from a single research institution.

There is one explosive influenza outbreak aboard an aircraft which was elegantly investigated by the Alaska branch of the Atlanta-based Center for Disease Control [6,7]. On March 14, 1977 a Boeing 737 with 49 passengers and 5 crew was bound for Kodiak, from Homer, Alaska. The port engine failed (without mishap) on takeoff and the aircraft's occupants were delayed for 4½ hours. During the delay, 30 passengers and crew remained in the aircraft and 23 others left and boarded the plane periodically. One of the passengers remaining on the plane was a 21-year-old woman who became acutely ill 15 minutes after boarding. She had symptoms of typical influenza—fever, chills, severe dry cough, and prostration. No other individuals reported illness at this time. While on the ground, the aircraft's ventilation system was turned off for approximately two hours. Within the incubation period for influenza (1–4 days), influenza-like illness afflicted 72 percent of the passengers and crew, 38 of 53 persons. Four persons required hospitalization. Diagnosis of influenza was well substantiated in the laboratory. Virus isolates resembling A/Texas/1/77(H3N2), a variant of Hong-Kong influenza, were obtained from seven individuals and 20 of 22 persons were diagnosed serologically as infected with the same virus. The paper describing the outbreak in detail is enclosed with this testimony [6]. The evidence seems to suggest overwhelmingly that these subsequent influenza cases in the passengers and crew resulted from exposure in the jetliner cabin to the 21-year-old acutely ill woman. The epidemiologic characteristics of this outbreak also suggest strongly that this oubreak was airborne; i.e., from contaminated cabin air. Since influenza can be a fatal illness, especially in elderly individuals with impaired cardiovascular or pulmonary systems, it is most fortunate that this instructive epidemiologic lesson did not result in tragedy.

This rather spectacular aircraft-related influenza outbreak was unusual in several ways:

(a) It was detected and followup was possible. The air traffic at Homer and Kodiak is not brisk and a single outbreak did not get lost in sheer volume. How many similar events would need to occur simultaneously at Washington National or O'Hare to attract attention? Followup was possible because of the alertness and expert experience of the public health authorities and the concentration of the passengers in only a few locations within a single sparsely settled state.

(b) The cabin ventilation system was turned off for two hours. This probably played a role in making transmission much more likely. However, even for those remaining in the unventilated cabin for less than one hour, the attack rate was 53 percent (8 of 15 persons). I am not aware of any experiments testing the effect of aircraft ventilation systems in destroying viruses.

(c) The index case in the 21-year-old woman was exceptionally severe for an air traveler. On the other hand similar cases must have occurred many times, simply by chance.

III. SOME PROPOSED INVESTIGATIONS OF MICROBIAL AIRCRAFT CABIN AIR QUALITY

(a) *The budget.*—I note that a budget of $500,000 from U.S. treasury funds is proposed to investigate the cabin air quality problem. I believe that it will be very difficult to perform other than a most perfunctory investigation with this sum. Has a scientifically reputable and epidemiologically experienced research group suggested a plan to conduct a conclusive study for this sum?

Particularly in view of the above-described influenza outbreak in the Alaska aircraft, has the Committee considered asking the aircraft industry itself to appropriate funds for this investigation? I am of course well aware of the present straitened financial circumstances of the industry, but the expense of about $2,000,000 to the airline industry as a whole would seem hardly noticeable and this amount should allow a conclusive study. In truth, I think that perhaps the aircraft industry should investigate ways to prevent the type of near disaster which occurred on the Homer-Kodiak flight.

(b) *Two suggested experiments—*

(1) Using presently installed ventilation systems, determine whether there is a high cabin density of bacteria usually found only in the normal nasal and oropharyngeal areas. These experiments should be conducted at low and at peak load situations.

(2) During the respiratory infection season (September through March), determine the attack rate for respiratory infection among passengers and crew at the beginning and 1-4 days following long flights. For these experiments it might be useful to concentrate on young children as they will be susceptible to many respiratory viruses.

It will be most interesting indeed to learn whether the nation is being seeded with microbes through the agency of its commercial air fleet.

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Senator INOUYE. It is your opinion that the existence of these bacterial colonies indicate that a potential danger is in the aircraft?

Dr. DICK. I interpret it as that. I might add that when I get back to Madison—I am a University of Wisconsin professor—we will determine what bacteria are in the colonies. I will send you the results with more accurate colony counts and with identifications.

But in all likelihood they are organisms from the nose and throat or perhaps from the skin and if you find them in the air, you can find pathogens there. In fact some of these may be pathogens.

Senator INOUYE. Now in the case of the influenza spreading among 72 percent of the passengers in Alaska, I do not suppose the ill person had intimate contact with the 72 percent; did she?

Dr. DICK. No, sir. That ill person was acutely ill and prostrate across two seats. She did not move from there. She was in contact with very few of the rest of the passengers. The epidemiologic characteristics of that influenza outbreak definitely appeared to be that of an airborne infection.

In my prepared testimony I put the reprint which describes in detail that study and referred to another report by Dr. Michael Gregg, which discusses the episode in more detail.

Senator INOUYE. If that woman sat in the third row from the back there and we were in this room, say, how long—70 minutes? Would 72 percent of us pick up that virus?

Dr. DICK. I can almost unequivocally say no. I can cite personal data. Like you, I spend a lot of time going over the Pacific. I do some of my research in Antartica and I fly there once or twice a year. As part of my investigations I investigated an influenza B outbreak. All of the men at the station there eat in the messhall three times a day and they usually spend 30 or 40 minutes there.

The influenza B apparently did not spread in the messhall. It is a well-ventilated messhall; so no, I would say it would be very unlikely that we would contract influenza from a spectator. I would not worry about it.

Senator INOUYE. Your concern is that sufficient study has not been made.

Dr. DICK. My concern is that sufficient study has not been made because there is clear evidence that there is a problem that exists. It was really unusual that this particular outbreak in Alaska was picked up. There is not much traffic between Homer and Kodiak, Alaska. This was an isolated and, accordingly, very visible incident.

Passengers usually scatter all over the country at the end of an airplane flight. The outbreak probably would never be picked up under normal circumstances. There were very alert physicians there in Alaska and the Alaska branch of the Center for Disease Control, which is very active in infectious disease, was available on the spot.

Senator INOUYE. You are suggesting that this could have happened in other areas and not be detected?

Dr. DICK. I believe that it is extremely likely that it has occurred many times. When you find it in one circumstance under unusual situations of isolation, how many times must it have occurred in Washington National or O'Hare or J.F.K. and never be detected? It is highly probable that this has occurred, perhaps not in that high an amount but perhaps so.

This may be the way we seed much of the country with some of our influenza viruses.

Senator INOUYE. Thank you very much.

Senator Goldwater, I think now I know why I am catching colds when I go back to Hawaii.

Senator GOLDWATER. If you stopped off in Arizona you could get rid of it.

Dr. DICK. When I fly to Antarctica I will suggest to the National Science Foundation that they allow me to enjoy a stop in Arizona.

Senator GOLDWATER. I would like to ask, Dr. Dick, of your knowledge of air movement in a cabin if it is sufficient to get rid of the

particles of contamination, or is it more or less recirculated throughout the cabin instead of being discharged?

Dr. DICK. I do not have a great deal of knowledge about that. If the air is recirculated, of course there would be nothing there to destroy the pathogens other than just a low humidity.

Incidentally, low humidity protects influenza viruses. Swimming pools, as you probably all know, have the same recirculation and they are chlorinated in order to destroy the bacteria and viruses therein. A very analogous situation, I understand, occurs within an aircraft.

Senator GOLDWATER. That is all I have.

Senator INOUYE. Are you suggesting that we could cope with this recirculation problem rather inexpensively?

Dr. DICK. I do not know if it could be inexpensively done, but I would think that it would be a very useful thing to try and if someone were given the challenge to develop a product, to do it inexpensively, I would be very surprised if he would not come up with one.

Senator INOUYE. Thank you very much.

Our next witness is Dr. Billings.

Dr. BILLINGS. Senator Inouye, Senator Goldwater, thank you very much for the opportunity to come down to Washington and comment on the issues presented by this bill. I would request, if I may, that you enter into the record the testimony as it has been presented this morning.

Senator INOUYE. Without objection, so ordered.

Dr. BILLINGS. Thank you very much. I am Dr. Charles Billings of the Johns Hopkins School of Hygiene and Public Health in Baltimore, Md. Dr. Gareth M. Green, chairman of the department of environmental health sciences of the school, has asked me to address the issues contained in S. 1770. I note in the testimony that views expressed here are my own and do not necessarily reflect those of Johns Hopkins University or of Dr. Green.

I am an environmental health engineer with over 30 years of experience in the study of the effects of human environments on human health, in the measurement of environmental contaminants and in the method for control of air contaminants in occupied spaces to protect human health.

The proposed bill on aircraft cabin environmental health and safety presents a broad range of subjects to be addressed in the proposed study and I have tried to indicate in table 1 approximately what I think the issues are that are raised in the bill.

The major issue areas identified include the items aircraft cabin air quality; contaminant characterization and levels, quantities, kinds of substances present, health effects from exposures to these substances, quantitative risk assessment and, finally, controls which might be required versus the health effects which are observed versus the risk.

First, dealing with aircraft cabin air quality, the aircraft cabin air contaminants include general categories of, one, gases and vapors, and, two, particulate materials. Table 2 attached to the text contains a more specific list of contaminants which have been reported or that have been identified or which are likely to be present in aircraft cabin atmospheres.

When I received this invitation to testify a week or so ago, I made a brief telephone survey of some of my colleagues who measure air quality with regard to human health and did a very brief literature search in order to find information available on the nature of aircraft cabin air contaminants. In summary, I find that only a very small number of studies of aircraft cabin air contaminants have been undertaken or, most importantly, reported in the open scientific literature, subject to peer review.

Most of the reported studies have been concerned, recently at least, with ozone drawn in with external air and supplied to the cabin ventilation systems. The higher altitudes flown by supersonic transports and subsonic aircraft in order to conserve fuel, both contribute to measured ozone levels in cabins during flight. The season of the year and stratospheric-tropospheric ozone interchange also contribute to observed ozone concentrations.

Ozone destruction apparatus and engine bleed air changes have been mentioned for certain aircraft or for certain operations. The FAA has proposed an aircraft cabin air quality standard for ozone—I did not review that—at one-tenth part per million over a 4-hour time-weighted average. Typically reported ozone levels in cabins from recent literature are given in appendix A.[1]

There appear to have been some measurements of tobacco smoke and other contaminants by the Department of Transportation in a study of the health aspects of smoking in transport aircraft in 1971. This is before the advent of the wide-bodied, long-range jets. These data apparently were never published and have not been reviewed.

Pratt & Whitney Division of United Aircraft apparently studied cabin contamination some few years ago from turbine bearing lubricants drawn in with the ventilation air. This report was not presented publicly and was never published.

There is a classic study on the nature of air quality in aircraft cabins by Rossano & Owens generated from the University of Washington in Seattle, reporting on design procedures to control cigarette smoke and other pollutants. The study was done in support of the development of the Boeing 747 aircraft ventilation system. This paper was not reviewed here. They reported that carbon monoxide and total suspended particulates were the principal measurements performed as indices of tobacco smoke generation and control.

Table 2 indicates there are a variety of potential aircraft cabin contaminants that may affect human health. As near as can be determined from a brief review, only a limited number of measurements of the kind or quantity of contaminants and sources have been made in aircraft cabin atmospheres during normal operations.

Senator INOUYE. May I interrupt at this point? It has been suggested by previous witnesses that to carry out this investigation would be redundant. Do you agree that sufficient studies and investigations have been made in this area? You just described——

Dr. BILLINGS. I suggest to you that I could find almost no data of any scientifically valid data in the public literature which addressed these issues. Therefore, some such study appears to me to be indicated.

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[1] The appendixes referred to have been retained in the committee files.

Senator INOUYE. Thank you. Please proceed.

Dr. BILLINGS. As near as can be determined from this brief review, only a limited number of measurements have been made during normal operations. Air quality is not monitored routinely. There appears to be no major air quality data base which can be used to address the health effects issues.

There are a variety of analytical devices which are available for many of the parameters which are likely to be present in aircraft cabin atmospheres—small pocket instruments which are used for industrial atmospheres. It is true that ozone, unfortunately, does not have that kind of instrumentation yet, but it has already been indicated that given a market for that kind of instrument there is no doubt that the manufacturers of these instruments could produce one which is portable and which could be used in aircraft.

The actual level of health effects from each of the contaminants are generally recognized as a function of concentration and duration of exposure, that is, dose. Health effects range from those reported here—nuisances, annoyance and irritation or other such symptoms—through measurable biochemical or physiologic change such as respiratory function and so on, through to illness and disease, all depending upon dose.

These effects may be exacerbated in susceptible population groups who fly. No health effects studies on flight personnel or passengers in aircraft was found, apart from the AMA Commission on Emergency Medical Services Air Transportation Report, which deals primarily with acute traumatic effects on sensitive individuals.

Human health effects of many of the substances listed in table 2 are the subject of National Academy of Sciences monographs. Effects of exposure to many substances at high altitudes are largely unstudied, so we really do not know the health effects.

Many of these substances are subject to Federal regulation by other agencies in other environments, but no agency has the direct authority to regulate indoor air quality in publicly occupied spaces such as aircraft cabins.

I will skip over the section on risk assessment because that brings me to the necessity for control and the question of acceptable risk. The controls for aircraft cabin air contamination include general ventilation with outside air to dilute concentrations to acceptable levels and alternatively, or in conjunction with that, use of air-cleaning devices to permit recirculation of the air. Other controls for passenger and crew comfort include temperature, humidity and air motion.

Common levels of dilution ventilation required or suggested for control of odors are given in appendix B and suggested levels of temperature and humidity in densely occupied spaces are given in appendix C.

Aircraft cabin air quality is a subset of the general national issue of appropriate control of indoor air quality. See, for example, the recent study by the National Academy of Sciences on the subject of indoor pollutants in all publicly occupied spaces. Methods for control of indoor air quality have been reviewed recently in a paper in appendix C.

Measurements of control system effectiveness in operating aircraft are not generally reported in the open literature, so we really do not know how effective these systems are on a routine operational basis.

In summary, we find that insufficient data are available on actual aircraft cabin air quality during normal operations to enable one to prepare a health risk assessment. Methods for air quality control are available, but may require adaptation to aircraft applications. It should be possible to recirculate cabin air through efficient collectors to restore acceptable air quality if that is a problem in costs.

The proposed study should provide a useful resource to identify issues of concern to the health of the traveling public. However, it appears likely that based on the testimony this morning, that the study ought to be done by an independent agency, as has already been suggested by my colleagues at the University of Texas School of Public Health.

Thank you very much.

[The statement follows:]

STATEMENT OF CHARLES E. BILLINGS, PH. D., ASSOCIATE PROFESSOR, ENVIRONMENTAL HEALTH ENGINEERING, SCHOOL OF HYGIENE AND PUBLIC HEALTH, JOHNS HOPKINS UNIVERSITY

I am Dr. Charles E. Billings of the Johns Hopkins School of Hygiene and Public Health, Baltimore, Maryland. Dr. Gareth M. Green, Chairman of the Department of Environmental Health Sciences, has asked me to address the issues contained in S. 1770.[1] I am an Environmental Health Engineer with over 30 years experience in the study of the effects of human environments on human health, on the measurement of environmental contaminants, and on methods for control of air contaminants in occupied spaces to protect human health.

The proposed bill on aircraft cabin environmental health and safety presents a broad range of subjects to be addressed in the proposed study, as indicated in Table 1. Major issue areas identified in the bill include: Aircraft cabin air quality (contaminant characterization), health effects; exposure levels; susceptibility of individuals, risk assessment, and controls required vs health effects vs risk.

Aircraft cabin air contaminants include general categories of (1) gases and vapors and (2) particulate materials. Table 2 contains a more specific list of contaminants which have been reported or identified or which are likely to be present in aircraft cabin atmospheres. A brief telephone survey and a literature search and undertaken to find data available on aircraft cabin air contaminants. In summary, one finds that only a small number of studies of cabin air contaminants have been undertaken or reported in the open literature. Most of the reported studies have been concerned with ozone drawn in with external air and supplied to the cabin ventilation system. Higher altitudes flown by SST's, (e.g., the Concorde) and subsonic types to conserve fuel contribute to measured ozone levels in cabins during flight. The season of the year and stratospheric-tropospheric ozone interchange also contribute to observed concentrations.

Ozone destruction apparatus and engine bleed-air changes have been applied for certain classes of aircraft or for certain aircraft operations. The FAA has proposed an aircraft cabin air quality standard (rule) for ozone (this has not been reviewed here) (0.1 ppmv TWA_4 or 0.25 ppmv peak). Typical reported ozone levels in cabins are given in Appendix A. There appear to have been some measurements of tobacco smoke and other contaminant levels some years ago by the DOT ("Health Aspects of Smoking in Transport Aircraft," 1971) but these data apparently were not published and have not have reviewed here. It was also reported that Pratt and Whitney Div. of United Aircraft studied cabin comtamination from turbine bearing lubricants drawn in with ventiliation air, but this apparently was not presented publicly.

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[1] The views expressed here are those of Dr. Billings and do not necessarily represent those of the Johns Hopkins University.

Rossano and Owens (1969) reported on "Design Procedures to Control Cigarette Smoke and Other Pollutants" in support of the development of the Boeing-747 wide bodied jet aircraft ventilation rate, air handling, and air cleaning systems. (This paper was not reviewed here).

They also reported that carbon monoxide (CO) and Total Suspended Particulates (TSP) were the principal measurements performed as indices of tobacco smoke generation and control. Table 2 indicates that there are a variety of potential aircraft cabin air contaminants that may affect human health. As near as can be determined from a brief review, only a limited number of measurements of kind or quantity of contaminants and sources have been made in aircraft cabin atmospheres during normal operations. They are not monitored routinely and there appears to be no major air quality data base which can be used to address health effects issues.

Actual level of health effects from each of the contaminants are generally recognized as some function of the concentration and duration of exposure (dose). Health effects range from nuisance, annoyance, and irritation or other symptoms through measurable biochemical and physiological changes to illness and disease, depending upon dose. These effects may be exacerbated in susceptible population groups such as the old, the young, and those already ill or of compromised function of the cardiopulmonary systems, or in individuals who are already sensitized to a particular contaminant. No health effects studies on flight personnel or passengers in aircraft was found apart from the report by the AMA Commission on Emergency Medical Services-Air Transportation (JAMA *247* (7) 1007, Feb. 19, 1982) dealing with acute and traumatic effects on sensitive or susceptible individuals. Human health effects of many of the substances listed in Table 2 are the subject of NAS/NRC Monographs. Effects of exposure to many substances at high altitudes are largely unstudied. Many of the substances are subject to federal regulation by other agencies in other environments (e.g., OSHA, EPA). No agency has the direct authority to regulate indoor air quality in publicly occupied spaces such as aircraft cabins, etc.

Risk assessment is a tool which may be used to develop policy, to apportion scarce economic resources, and to determine level of control required for acceptable risk. Risk assessment requires knowledge of the dose-response relationships for individual effects and contaminants. A brief review of available literature indicates that limited studies of dose (exposure concentration X time) have been performed, with apparently no health effects studies on aircraft flight crews or passengers. We conclude that there are inadequate data upon which to judge health risks based on air quality during normal operation. The issue of risks associated with on-board fires and post-crash fires is further complicated by complete absence of data.

Controls for aircraft cabin air contamination include general ventilation with outside air to dilute concentrations to acceptable levels and use of air cleaning devices to permit recirculation. Other controls for passenger and crew comfort include temperature, humidity and air motion. Common levels of dilution ventilation required or suggested for control of odors, and suggested levels of temperature and humidity in occupied spaces are given in Appendix B. Aircraft cabin air quality is a subset of the general national issue of appropriate control of Indoor Air Quality (see for example, *Indoor Pollutants,* NAS/NRC, 1981). Methods for control of indoor air quality have been reviewed recently as indicated in Appendix C. Measurements of control system effectiveness on operating aircraft are not generally reported in the open literature.

In summary, we find that insufficient data are available on actual aircraft cabin air quality during normal operations to enable one to prepare a health risk assessment. Methods for air quality control are available if needed, but require adaptation to aircraft applications. It should be possible to recirculate cabin air through highly efficient collectors to restore acceptable air quality at a saving on bleed air fuel costs.

The proposed study should provide a useful resource to identify issues of concerns to the health of the travelling public.

TABLE 1. AIRCRAFT CABIN ENVIRONMENTAL HEALTH AND SAFETY PARAMETERS FOR STUDY AND REPORT S. 1770

FAA/DOT to conduct study on following:

1. Q fresh air per occupant (air quality vs health effect vs comfort overall air quality on board.
2. Amount of humidity, quality of humidity (i.e., sources).
3. Air contamination limits.
4. Emergency breathing equipment toxic fume protective breathing equipment.

5. Methods for extinguishing fires on board (apparatus procedures, capab.), methods for removal of smoke and toxic gases.

6. Safe pressurization in respect to cardiopulmonary health of pass: Medical advise on health effects of air travel, simultaneous effect of press/low O_2 + toxic conts. not known, health statistics data base on air travel to assess adequacy, FAA to study—report to congr. 6 mos, utilize available studies, and authorizes 500k FY82.

Cabin conditions during an emergency—On-board fire in flight: CO, Smoke + fumes, and Pyrolysis degradation products of aircraft comp. structure/furnishing,/ coatings systems (e.g., CN^-, etc.).

Post-crash fire.

TABLE 2. LIST OF CONTAMINANTS LIKELY AS ISSUES FOR EXAMINATION IN AIRCRAFT CABIN ATMOSPHERES

Chemical Substances.—Gases and Vapors. Ozone (from ventilation air supply from outside.)

Carbon monoxide—From smoking, from air supply, and from fires.

Organic Vapors—From smoking materials (pyrolysis degradation products) and from cooking.

Moisture Vapor—From human exhalation, perspiration, cooking, toilets.

Biological Effluents—Odor, perspiration, microorganisms (e.g. bacteria, virus) humidity, CO_2, dander (skin scales, hair, etc), perfumes, fragrances, from individuals + from toilets.

Other sources and substances.

Physical agents.—Pressure level, heat, Ionizing Radiation, Non-ionizing Radiation (U–V not likely inside closed cabin).

Particulates—Smoke: From cigarette smoking; "tars and nicotine"; from on-board fire pyrolysis, incomplete combustion products, tiny soot-like chains at high conc. (obscure visibility); drawn in from own engines by recirculation of exhaust, during flight line hold or taxiing;

Also may be from surrounding aircraft on ground waiting.

Turbine engine compressor lubricant mist droplets, hydraulic fluids leakage from flight control systems, organic viable particles (see above, biological effluents), and other sources.

Senator INOUYE. Thank you, Doctor. I cannot cite the specific statistics, but one was led to believe after listening to some of the witnesses this morning that everything was fine. Just one out of so many thousand passengers reported any problems.

I gather from your testimony that we really do not know how many passengers have been affected; would that assessment be correct?

Dr. DICK. Absolutely.

Dr. BILLINGS. I would agree.

Senator INOUYE. In fact, would that also be true as to the number of death, fatalities?

Dr. DICK. We have no data for that.

Senator INOUYE. In fact, no one knows.

Dr. DICK. Nobody knows; that is correct.

Senator INOUYE. But you are convinced that the potential for severe medical problems do exist?

Dr. DICK. I certainly am.

Senator INOUYE. Is that your conclusion too, Dr. Billings?

Dr. BILLINGS. I would say that the potential is always a possibility, but additional information is necessary from a risk point of view.

Senator INOUYE. And you have no information available or very little at all.

Dr. BILLINGS. There is nothing in the open literature, or very, very little of any definitive nature that would allow you to do a risk assessment. That is, no health effects studies have been done.

No air quality monitoring studies have been done. And so it is impossible to do a risk assessment.

Senator INOUYE. Have you checked with the FAA, because the FAA suggested that they have got all kinds of studies that have been carried out?

Dr. BILLINGS. With all due respect to the agency represented by the individuals who are present here this morning, I submit, sir, that if a study is done by an independent agency and published in the open literature and subject to peer review, it is much more likely to be accepted by the scientific community than if an agency does it and does not distribute it in a public forum or it does not have peer review.

Senator INOUYE. If what you say is true, why did the AMA, according to the witnesses, indicate that studies were not necessary?

Dr. BILLINGS. I am not sure what issue the AMA was addressing with that specific conclusion.

Senator INOUYE. They cited some resolution adopted by the AMA that studies were not necessary, that everything was fine.

Dr. BILLINGS. I do not recall that specifically. Did it have to do with emergency medical apparatus?

Senator INOUYE. I think that related to the medical kit.

Dr. BILLINGS. I have no comment on that at all.

Senator INOUYE. Well, your testimony concerns me because of the number of trips that I have to take. I used to think that my system was getting a little weak when I found myself coming down with a cold or the flu after every trip and now I think I have found the answer. What can I do to prevent further occurrences as an individual if we have no rule or regulation that would assist me?

Dr. DICK. I have no recommendation since the air is generally circulated. Senator, there is no way for you to get rid of it except to do as one does in swimming pools; that is, to see to it that the air is pretty well sterilized.

When I was coming out here I was listening for coughs. I did not hear very many. I hate to suggest that people be screened for respiratory infection before they come in. That would be an enormous job and probably unnecessary. But I was awfully impressed with the infectiousness of that young lady in Alaska. Not that she was particularly deficient, it was her severe disease.

Senator INOUYE. Well, your testimony frightens me. I am generally not one that frightens easily, but I would think that with this type of testimony the FAA should be concerned also.

Do you think the cost that may be involved in the investigation would serve the best interests of the Nation?

Dr. DICK. I most certainly do, and I would like to reiterate what Dr. Billings said. I suggest that any study be done by independent investigators who are well trained and that it be presented and published in the scientific literature. There is an appalling paucity of data in both his area and mine. I was very surprised by so few citations and I think study is urgently needed. Again, it must be done by someone who is scientifically above reproach and has no reason to find results one way or the other.

Senator INOUYE. With that happy note, I thank you very much and would like to call a short recess while I go vote.

[A brief recess was taken.]

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Senator GOLDWATER [presiding]. The meeting will come to order.

On our last panel we have: Dr. John Keshishian of Washington; Dr. Carl Almond, professor of surgery at the University of South Carolina; and Mr. John Ralph, whom I should call General, senior vice president, operations and technical support, Air Transport Association.

You may either read your statements or they will be put in the record as if read and you may summarize them.

STATEMENT OF DR. JOHN M. KESHISHIAN, WASHINGTON, D.C.; AND DR. CARL ALMOND, PROFESSOR OF SURGERY, UNIVERSITY OF SOUTH CAROLINA

Dr. KESHISHIAN. Good afternoon, Senator.

Since Dr. Almond and I prepared this report together, I may run over a minute or two into his time, and then he will have a few remarks to make as well. And then, since we only address ourselves to the problem of medical kits, we could come back and talk about cabin air environment if you so wish, if that is agreeable with you.

For our bona fides, both Dr. Almond and I are professors of surgery, and I am here at George Washington. Dr. Almond is professor and chairman at the University of South Carolina. We both actively teach and practice thoracic surgery, which is the practice, the specialty of lung, heart, arteries, and so forth.

Additionally, we are both rated pilots and we were uniquely qualified, I think, to serve as medical consultants to the Administrator of the FAA. And in addition, we sat on the panel of medical consultants to the Federal Air Surgeon.

I assisted the Medical Society of the District of Columbia here in convincing U.S. air carriers that discreet no smoking sections should be designated aboard all aircraft. This policy was rapidly adopted by the European air carriers as well.

I and Dr. Almond have also served on ad hoc task forces for the FAA to study aircraft cabin environment. I would like to come back to that later. In addition, we directed a study to determine whether passengers with implanted cardiac pacemakers were at risk when passing through airport metal detectors.

So for these reasons some of our remarks should serve as a credible source of information for the further deliberations of your subcommittee here.

Now, it is a sad reflection on the U.S. air carriers, the FAA and the Federal Air Surgeon and the Federal air regulations when one realizes that there is no unanimity of opinion, nor uniformity of contents in aircraft first aid kits, if indeed any of these are available and exist. The FAR's are lax to a degree that many of these carriers satisfy only the barest minimums in having anything in the kits. And when they exist, these kits differ so much from one airline to the other that it is hard to single out any one as having anything adequate. In fact, they are totally inadequate for any onboard medical emergency.

So we have to compare them with foreign carriers and, as has been pointed out in Dr. Finucane's remarks, he pointed out this ar-

ticle about the idealized in-flight medical kits, a report. I served on this committee and I can tell you, we put a lot of time into it.

Senator Inouye [presiding]. We will make that part of the record, without objection.

Dr. KESHISHIAN. There are two excellent articles I commend to you for your reading. This information was given to the Federal Air Surgeon and it has not yet been acted upon. In fact, I think it has been totally ignored.

I must say, the philosophy of the foreign air carriers is completely opposite that of the U.S. air carriers and the Federal Air Surgeon vis-a-vis the necessity for these on-board kits. You would be surprised to know that some of the European carriers may have as many as three kits, one to handle obstetrical problems, one to handle any sort of medical problems, and one for medications.

The reasons cited——

Senator INOUYE. If I might interrupt at this point, have the Europeans encountered any problems of misuse of these kits?

Dr. KESHISHIAN. No; we do not have any problems either. Our problems are imagined. And I can come back to that later if you wish.

The reason that our air carriers indicate that they are reluctant to implement their kits is because they say they are susceptible to theft. Well, that maybe true, but so are everyone else's. The fact that there might be medication on board might be an irresistible urge to steal them.

Furthermore, there is no guarantee that personnel trained in emergency first aid procedures would be present among the crew members on any given flight; that there is no Good Samaritan law which will hold blameless the air carrier and the person rendering immediate first aid, and for this reason air carriers wish to avoid a potential lawsuit by an irate or otherwise disgruntled passenger. So if there is no first aid kit aboard, there can be no charges for assault and battery, because no one can do anything. So it might be wise to consider a Good Samaritan law.

Now, avoidance of the "looney factor." Occasionally a nonqualified layman will respond when requests for a physician are piped aboard the loudspeaker, and these people can be anywhere from a Walter Mitty individual to a chiropractor or whatever.

A number of years ago Dr. Stanley Mohler and Dr. Arnauld Nicogossian—at that time Dr. Mohler was FAA and Dr. Nicogossian NASA—put together the ideal, their minimums for a first aid kit, which was present in Dr. Finucane's report. Dr. Mohler and Dr. Nicogossian are understandably upset. They had devised a medical kit, they had devised techniques to revive someone. But what is the sense? Say, Senator, you have a heart attack. What is the sense in reviving you if here is there is no lidocaine, which is a medicine, or adrenalin or something like that, to keep you alive? Their attitude is, forget it, we cannot keep them alive because we do not have the medicines.

Now, for that reason I and many other physicians surreptitiously carry aboard medical supplies, equipment, little things that we know can help. And if the occasion demands we will step forward.

Once when I was riding jumpseat as an FAA observer, as a medical check examiner, we did have an on-board medical emergency.

The captain asked me to go back and I went back. And it was a Central American citizen who was having convulsions. The stewardess was giving him oxygen, which was probably inappropriate for the situation.

I went into his pockets and found that the medicine containers were empty. He had probably been drinking. We stopped his convulsions. I told the captain to land, got the medicine, and we could resume the flight later. But before the captain would land he radioed Washington to see whether I really was what I said I was, even though I had FAA certificates with me.

So for these reasons, I think that the Federal Air Surgeon, who is probably derelict in his duty in not pushing this, should be required to study and implement a first aid kit which would be appropriate for the situation.

We have such things as bouts of nausea, vertigo, baro-otitis media. And I can say that humidity or the lack of humidity will dry up mucosal membranes and the drying out of mucosal membranes can cause such things as stopped sinuses and stopped eardrums. If you have ever heard a child scream with a stopped eardrum, that is baro-otitis media. That can be alleviated if there is enough moisture in the air, and it can also be alleviated if they have enough sprays or neosynephrine drops, and some of the airlines do not have them.

I think that at this time I ought to stop and ask Dr. Almond if he would like to carry on. And I can come back and answer any questions you wish.

[The statement follows:]

STATEMENT OF DR. JOHN M. KESHISHIAN, WASHINGTON, D.C.; AND DR. CARL ALMOND, PROFESSOR OF SURGERY, UNIVERSITY OF SOUTH CAROLINA

Dr. Keshishian is Associate Clinical Professor of Surgery at the George Washington University School of Medicine and Health Sciences in Washington, D.C. and Clinical Professor of Surgery at the USUHS in Bethesda, Maryland. Dr. Almond is Professor and Chairman of the Department of Surgery, the University of South Carolina in Columbia, South Carolina. Both Drs. Keshishian and Almond are specialists in thoracic surgery and are currently active in teaching and practice on their respective university faculties. Both and rated pilots and thus were uniquely qualified to serve as Medical Consultants to the Administrator of the FAA and sat on the panel of Medical Consultants to the Federal Air Surgeon.

Additionally, Dr. Keshishian and Dr. Almond in concert with the Medical Society of the District of Columbia were instrumental in convincing U.S. air carriers that discrete "No Smoking" sections should be designated aboard all aircraft. This policy was rapidly adopted by European and other international air carriers. Dr. Keshishian has also served on ad hoc task forces for the FAA to study aircraft cabin environment and earlier directed a study to determine whether passengers with implanted cardiac pacemakers were at risk when passing through airport metal detectors.

For these reasons, these remarks should serve as a credible source of information for deliberations of this subcommittee.

It is a sad reflection on the U.S. air carriers, the FAA, the Federal Air Surgeon and the Federal Air Regulations when one realizes that there is no unanimity of opinion nor uniformity of contents in aircraft first aid kits, if indeed such are present and available. The Federal Air Regulations are lax to the degree that many of the carriers satisfy the barest minimums and do not carry adequate first aid kits on board. Since the kits differ from one airline to the other, it is hard to single out any one carrier to compare with another. In general, they are totally inadequate in the face of an onboard emergency.

This brings us to a comparison with foreign carriers. In short, most European air carriers, notably Lufthansa, Air France, British Air, KLM, Swissair, El Al and numerous others carry very sophisticated and complete first aid kits which can handle

most on board emergencies at altitude. The philosophy of the foreign air carriers are completely opposite those of the U.S. air carriers and the Federal Air Surgeon vis-a-vis the presence of on board medical kits.

The reasons cited by the U.S. Air carriers who are reluctant to implement their kits with effective instruments and medications are:

1. Susceptible to theft. The presence of narcotics, it is stated, may be an irresistible invitation to purloin the kits.

2. There is no guarantee that personnel trained in emergency first aid procedures will be present aboard the crewmembers assigned to a given flight.

3. That there is no Good Samaritan law which will hold blameless the air carrier and the person rendering immediate first aid. For this reason air carriers wish to avoid a potential lawsuit by an irate or otherwise disgruntled passenger. If no first aid kit is aboard, then no charges for assault and battery can be brought up. Therefore what is aboard is harmless and probably worthless as well.

4. Avoidance of the "looney" factor. Occasionally a nonqualfied layman will respond when requests for a physician are piped over the loudspeaker. Persons may range anywhere from a Walter Mitty type individual to a thoroughly unskilled person and thus leaves the air carrier open for a lawsuit. The air carriers cannot request any physician to volunteer unless the physician knows full well that the Good Samaritan Law in fact exists.

A number of years ago Dr. Stanley Mohler and Dr. Arnauld Nicogossian, two noted aviation medical experts, devised a technique for on board cardio-pulmonary resuscitation. But they have despaired of attempting to resuscitate an individual, if, following a heart attack, no drugs were available to sustain the individual.

Many physicians have taken to carrying their own first aid equipment on board and depending on a given emergency situation may volunteer their services. This may be a problem, however, since a physician rarely documents his presence before boarding the aircraft. Steps could be taken to remedy this.

Certain of the flight attendents will carry a personal first aid kit and on occasion will assist a stricken passenger with some of their personal medications. For example: Bouts of nausea, vertigo, baro-otitis media (stopped up sinuses and trapped air behind the eardrums), hysteria, menstrual cramps, arthritis or similar painful disorders, decongestant sprays and medications for allergies or stuffy noses in general.

On occasion there have even been midair obstetrical deliveries assisted by nurses and physicians with very little help from the air carriers first aid kit.

The aforementioned Dr. Stanley Mohler had been directed to prepare an ideal medical kit for inclusion aboard U.S. air carriers. Assisted by the authors as well as other airline medical personnel, the outline of an ideal first aid kit was presented the Federal Air Surgeon. It should be noted that there has been little change in the contents of the first aid kits since before World War II. It should be further remembered that nurses were employed as flight attendants on the earliest passenger craft. Unfortunately, the Federal Air Surgeon has not acted on Dr. Mohler's recommendations. If there has been any action, no knowledge of this fact is available to us. We attempted to contact the appropriate members of the Federal Air Surgeons Office connected with this problem but could not reach any responsible individual.

The Federal Air Surgeons Chief of Safety Regulations has indicated that there have been certain circumstances which have prevented the completion of a necessary cost benefit study for preparation of first aid kits. If this is correct, it appears to be a frivolous attitude, given the number of on board medical emergencies which occur daily.

According to the Aerospace Medical Association, serious emergencies ranging from cardiac arrhythmias to insulin shocks occur daily.

In an effort to determine how many medical emergencies occur daily, we tried to gather this information from airline medical directors. These attempts were unrewarding. In many instances, on board emergencies may not be considered serious enough to report. If they are reported to the air carriers medical director, they sometimes do not reach the NTSB if no serious consequences arose. Therefore in order to obtain a true picture, this Subcommittee should request this data from the NTSB as well as the Medical Directors of the U.S. air carriers.

The authors have had such personal experience with on board medical emergencies.

On one particular occasion, one of us (JMK) was riding jumpseat as an official FAA observer aboard Pan Am 541 from the West Coast of the United States to Central America. On that flight a Central American citizen began to have seizures. It was quickly determined that this was an epileptic-type seizure and that the medication containers in his pocket were empty. The captain alertly radioed ahead and on landing at LAX the physician was able to obtain appropriate medication. After a

slight delay, the flight was resumed; the patient reached his destination safely. It was of interest to note that the captain, not trusting the physician's competence contacted Washington to learn if in fact he was what he represented himself to be. This was an admirable response on the part of the captain, but may have represented an overzealous attitude. Pan American was suitably grateful. But it's entirely possible that this incident could have been aborted while the aircraft was at altitude if certain medications had been aboard the craft.

Given the present shambles of the airline industry, it is understandable that they are primarily concerned with survival. One can understand their reluctance to invest in sophisticated first aid equipment. But there is precedent for this since the Department of Transportation recognizes that first aid equipment is present aboard buses, steam-ships and railroads. European air carriers seem to have no problem in assuring that appropriate medication will exist on board their aircraft. Since the captain is in charge of the flight, he maintains his equipment under lock and key and it is released only at his discretion. This can very easily be done aboard U.S. air carriers.

If blame can be directed at anyone, it should be directed at the Federal Air Surgeon and his associates. It may be that the Administrator of the FAA is not aware of the sad status of the first aid kit situation. There may be some extenuating reasons why the Federal Air Surgeon has been derelict in this aspect of his job. It is recognized that none of the medical directors of the airlines would wish to have equipment on board if there was any risk of a lawsuit. Pressure by these various air carriers on the Federal Air Surgeon must have some effect in guiding his thoughts. It might be well to ask his opinion in this regard.

We have consistently plumped for the inclusion of the kits as designated by the Mohler ad hoc committee. Since Dr. Mohler is no longer associated with the FAA, he has been free to work on his own. Medical kits suitable for inclusion aboard aircraft do exist. We would urge that the Subcommittee take action to demand that the Federal Air Surgeon and the Federal Aviation Administration upgrade their medical kits forthwith.

Attachment.

EFFORTS TO UPGRADE AIRLINE MEDICAL KITS?

WASHINGTON.—Claiming added support from doctors, two consumerist groups here have renewed their demands that the Federal Aviation Administration make passenger planes upgrade their medical supplies.

Last year the Public Citizen Health Research Group (HRG) and the Aviation Consumer Action Project petitioned the FAA to ensure that physicians stepping forward for in-flight emergencies could count on more than the oxygen and simple first-aid kit currently required (MWN, March 16, '81, p. 44). Now a letter to the agency by the petitioners' lawyer claims new support—notably from doctors—and asks why a rule change hasn't been promulgated.

When the period for public comment on the petition ended in October, the federal docket showed about 100 allies and only three opponents, says HRG internist Eve Bargmann, who signed the petition with his group's director, Dr. Sidney M. Wolfe. But William J. Sullivan, FAA's chief of safety regs, says his staffers found the comments "substantial on both sides" and that other pressures have delayed completion of a necessary cost-benefit.

Dr. Wolfe's nonprofit group cites estimates that doctors are on 75 percent of long-distance flights and that 20 percent of physicians have answered at least one in-flight call for help. The Aerospace Medical Association says "serious" emergencies ranging from arrhythmia to insulin shock occur daily. Yet, say the petitioners, kits on American planes have "little more than a few bandages and splints," not even a stethoscope, and no medication besides a burn ointment.

They want the FAA to consider what's carried by some foreign airlines and recommended by the aerospace group—items including suction and intubation equipment plus drugs ranging from nitroglycerin to phenobarbital. Aviation doctors note, however, that the drugs could pose shelf-life and theft problems for airlines.

Dr. Bargmann says the HRG is still trying to "gently encourage" the aviation agency and avoid the need for legal action.

SUMMARY

Despite numerous requests from consumer groups and aviation medical specialists, to the FAA and the Federal Air Surgeon, the U.S. Carriers do not have adequate first aid kits aboard aircraft. Foreign flag carriers have excellent first aid kits and medicines aboard their craft. The reasons for this are delineated in the accom-

panying statement. The Federal Air Surgeon and the FAA should be directed to implement a first aid kit as recommended by the Aerospace Medical Association.

Dr. ALMOND. It is a pleasure to be here and I appreciate both of you allowing us to come.

First, to identify myself, I am a professor and chairman of the department of surgery at the University of South Carolina. I started as a naval aviator in World War II and have stayed in aviation ever since, and have had the opportunity and privilege of serving in the FAA National Medical Advisory Board for 4 years, and have been active in aviation consistently.

I came because I am interested and concerned in the problem of in-flight medical emergencies. Also, as Dr. Keshishian has pointed out, we have been very interested over the years in the air quality in the cabin relative to smoking, ozone and the other problems, and, as identified today, the bacteriological problem in there and the spread of disease.

To me there really are about three parts of this that we are addressing here today. If I may concentrate on that for just a couple of minutes.

No. 1, I think it is important, and I think Senator Goldwater mentioned this this morning very appropriately, that physicians sometimes are a little bit concerned about coming forward to address the issues of illness and emergencies in airplanes because of the liability situation under which they may become entangled. And consequently, I think it is very creditable of the two of you, and I thank you for suggesting that good samaritan legislation may be terribly important to assist in that situation.

I think this would be most helpful. I think it would support the people, whether they be physicians, whether they be nurses, or whoever they are, to come forward, realizing that they will not get caught into a long libelous situation, and then can go ahead and perform and give of themselves what they have the opportunity to do, and I think that is important.

The next area relates to the medical emergencies. This really breaks into two parts. We are really talking about equipment and drugs here, and then training.

Basically, in-flight equipment, if any of you have had the opportunity, is as I think all of us have at one time or the other, to become choked and get into a severe respiratory distress with this, it is imperative that if one is going to save the life in this emergency that there is adequate equipment on board to do it, because if there is knowledgeable personnel and no equipment you cannot save the person's life all the time. Sometimes you can do it by certain maneuvers which have been taught through the Red Cross and the first aid groups and so forth, and maybe even by one of our thoraic colleges.

But basically you need equipment, and it is very simple equipment. It is inexpensive equipment and it should be on board in my opinion in all of the major aircraft today.

I think as we have grown up over the years we have changed. We came from small aircraft to bigger aircraft, and now we are carrying a lot of people and we have got a lot of people in the air every day.

It is demonstrated here today that there is probably one emergency landing per day in the United States. The figures are 300, so maybe we are a little short because there are 365 days. But there is almost a landing every day, an emergency landing of necessity, which is very costly and probably in most instances could be prevented if that emergency equipment used by knowledgeable personnel, if the equipment were on board and the personnel could use it.

The second part of that becomes support drugs, and this is what Dr. Keshishian was addressing a few moments ago. And as Senator Goldwater has said, Band-aids are nice, but if you really need resuscitation type drugs you are going to have to have something more than Band-aids. And I think this is critically important that we do identify the drugs, that they be put under lock and key and they be put under proper supervision.

But those two items would change things considerably.

The next issue that needs to be addressed is: Why is there the problem? We really should not be addressing the problem. Today it should not exist. My own feeling is that we need strong leadership in the FAA medical area of knowledgeable people to understand what these problems are, who are willing to face the problems, who will initiate and support the kind of research by knowledgeable people who can carry out the kinds of studies that need to be done on these aircraft and quit dragging their feet about it.

In other words, they have been totally resistant, totally defensive, and have not come appropriately forward with innovative ideas. And I think that this is an area that really needs to be looked at hard, because knowledgeable people would move in these areas and they would move in them very expeditiously.

And I do not think there is any reason for the FAA to be defensive. I think they should be aggressive, because each of you have the need, each of us have the need, and there is no reason not to face these facts and to move forward and do something about it.

Thank you.

Senator INOUYE. Senator Goldwater?

Senator GOLDWATER. Well, I think this testimony has been very revealing. And I am particularly interested in this good samaritan concept.

Has there been a history of airlines, that they have been sued when either doctors have volunteered their services or quasi-doctors? Has there ever been litigation developed over the activities of a person on board an aircraft to try and help a passenger?

Dr. KESHISHIAN. Yes, I think so. I am not sure which airline it was, but there were one or two instances where an hysterical woman claimed assault and battery when someone was trying to help her. The NTSB should have a record of this.

The National Transportation Safety Board must know of every incident that takes place. The cabin crew is required and the captain is required to file a report with his airline office. The medical director of the airline is required to file it with NTSB. And I am willing to bet that half of these are not done.

But the medical directors will tell you that is the one thing they are terrified of, Senator, that some hysterical person will wake up from a faint with ammonia under their nose saying, I have been attacked. So, I can understand their skittishness, but if that one

problem were eliminated then the FAA and the airlines would have no reason to object to anything.

The Federal Air Surgeon is under a great deal of pressure from the airlines, from industry, from the Air Line Pilots Association, the Air Transport Association. They do not want any more work, they do not want any more responsibility. They figure they have got enough to do. That is one of the problems.

Dr. ALMOND. I think another part of that, too, is carryover. Many physicians have been sued, as you know, relative to stopping and helping at automobile accidents, and they get sued for two or three reasons.

No. 1, they get sued for abandonment. And this is a problem you run into with the airline situation as well as the auto situation, because basically the physician has to give up that particular position which he has taken in treatment of that patient at a given time. That means he has got to move the authority over that case over to somebody else, and therefore if that individual then says something went wrong during that period of time he can get sued for abandonment, and this is part of the problem.

The good samaritan law takes care of this, and I think you gentlemen could cure a great deal of that.

Senator GOLDWATER. This is very interesting. And I am not a lawyer, so it is hard for me to judge. But I am going to ask—and the staff will get into this whole matter—I cannot conceive how an airline could be sued because somebody tried to help somebody else, although I have to admit that people sue on any reason at all in this country.

Senator INOUYE. It happens every day.

Senator GOLDWATER. Well, that is why you lawyers live so well.

Dr. KESHISHIAN. I would urge you to get that data from the NTSB. I think you will be amazed.

Senator GOLDWATER. Just as a matter of record, do you have many babies born on airplanes?

Dr. KESHISHIAN. Yes. I have assisted in one delivery over the Atlantic. I did not do a very good job, but nature helped. It happens quite frequently, sir. In fact, the airlines request that you advise them of the exact status of your trimester before you get on, and sometimes they will deny you a passenger ticket.

Senator GOLDWATER. And you have nothing on board to assist?

Dr. KESHISHIAN. No.

Senator GOLDWATER. I guess you do not need it.

Dr. KESHISHIAN. Well, it used to be that the stewardesses were nurses at one time. We do not have those any more.

I would like to come back for 1 second, if I may, and then I will shut up. The FAA and some of the other gentlemen talked about cabin air quality, air studies. I served aboard an ad hoc task force of the ill-fated 1971 report that never surfaced. I was one of the senior medical officers on that. We had engineers, public health officials and so forth.

We flew aboard a crowded DC-8 Stretch full of soldiers and landed in Japan. We had portable equipment that measured everything you can imagine. Unfortunately, the results were flawed because the equipment was not working well, so the report never came out. To my knowledge, no subsequent report has been made.

The aircraft was blue with smoke. Almost every soldier smoked. The overboard dump valve, which is the valve that is activated when the pressure exceeds whatever the engineer sets it for, usually 8,000 feet, the overboard dump valve sometimes gets gummed up and stuck because of the gunk and nicotine. And you can see it alongside the craft from the smoking. So that same stuff gets in the circulating air and deposits itself on some of the navigational equipment, because it goes through the cockpit and back out.

They should have a filter, but they do not. The air that is bled in from one of the engines should have a filter and it does not.

Senator INOUYE. Even to this day?

Dr. KESHISHIAN. Even to this day. Subsequent aircraft do. Now, let us see. The SP-747 and maybe the Concorde, that fly at flight level 410, have filters, but they also have activated charcoal and catalytic units to get rid of the ozone, which is nothing but high-class oxygen.

So there are a lot of things that could be done that are not done under the heading of expense, which is pure baloney.

Senator INOUYE. Do you maintain that smoking in an aircraft is a health hazard?

Dr. KESHISHIAN. Absolutely, there is no question about it. If you smoke next to someone——

Senator INOUYE. What would lead the FAA doctors to say there is no evidence that indicates that?

Dr. KESHISHIAN. Because they probably do not have any evidence. But I can document that some people have asthmatic attacks, some people will have nasal sinusitis. I know a lady that has an allergy and she gets a headache and starts sniffling right away in the presence of x number of particles per million of cigarette smoke.

One of the United Airlines stewardesses, one of these girls, was absolutely correct when she said they walk in a blue haze in the cabin, because the smoke goes up. They are walking upright and we are sitting down. The blue haze is above us.

Flight engineers usually turn off most of the air-conditioning to save fuel—which is also a fallacy—so that they may not have all three packs working at once. And I have sat in a cockpit and heard the engineer say, I want to cut down the units or altitude.

Senator INOUYE. Is it true that the air quality in the cockpit is different from that in the rest of the plane?

Dr. KESHISHIAN. It is hard to say, Senator, because it varies from plane to plane. Probably yes. It is also hotter up there during the day because of the greenhouse effect. But as you know and as the Senator knows, when the captain gets up and leaves the copilot has to strap on an oxygen mask in case something goes wrong.

Generally it is cooler up there if the air-conditioning is working and nobody is smoking. If the captain says, I do not want anybody smoking up here, they will get up and go in the back. Of course, in the rear of the aircraft it is very smoky.

So at the nose of the aircraft, in the cockpit, oxygen is probably better. Midway back in the cabin, where there is no smoking, it is better. But you go back in the tail, where it says no smoking, in the bathrooms and so forth; people are back there lounging and smoking, and it stinks.

Senator INOUYE. The moral of the story is to buy a seat in the front.

Dr. KESHISHIAN. That is right.

Senator INOUYE. Which is expensive.

Dr. KESHISHIAN. That is correct. Or else be an FAA inspector.

Senator GOLDWATER. We have been talking here about all of the modes of transportation that carry medical equipment. Am I correct in remembering that freighters at sea do not have to carry a doctor if they carry less than a crew of 13?

Dr. KESHISHIAN. I do not know about that one, sir.

Dr. ALMOND. Senator, I am terribly sorry, I do not know the rules and regulations there.

Senator GOLDWATER. I think that is true, and I think that is why when you travel by freighter you see crews of 13 or less, because there are no doctors aboard.

I just cannot for the life of me understand why the airlines of our country and the FAA are so reluctant to do anything about this. And I think it is probably going to be the judgment of this committee—and I am only speaking as one member—that we instruct the FAA to do something about this. And if they do not do it, I will very happily introduce legislation that will require it.

I do not think we can continue in this country to not provide at least a basic selection of medicine for in-flight happenings. And I do not care how careful we are, we are going to have them.

I think I first became interested in this when Dr. Keshishian and I started talking about it, and I was utterly amazed when he told me that we did not have first aid equipment aboard aircraft. That is when I started asking questions. As I say, I have not found many of them.

I want to thank these people for coming. They have provided excellent testimony and excellent background.

General, do you have anything you would like to add?

STATEMENT OF JOHN E. RALPH, SENIOR VICE PRESIDENT, OPERATIONS AND TECHNICAL SUPPORT, AIR TRANSPORT ASSOCIATION, ACCOMPANIED BY DR. C. RICHARD HARPER, VICE PRESIDENT, MEDICAL SERVICES, UNITED AIRLINES; AND DR. ROBERT L. WICK, CORPORATE MEDICAL DIRECTOR, AMERICAN AIRLINES

Mr. RALPH. Senator Goldwater, Senator Inouye, I have with me today Dr. C. Richard Harper, vice president of medical services for United Airlines; and Dr. Robert L. Wick, corporate medical director for American Airlines.

We are aware that our testimony can be made a part of the record and we would request that.

Senator INOUYE. Without objection, so ordered.

Mr. RALPH. And I would think that, in view of the many questions that have been asked, perhaps these gentlemen may have something to offer that would be worth consideration. So in that regard, I suggest that we simply respond to your questions that you might have concerning the subject.

[The statement follows:]

STATEMENT OF JOHN E. RALPH, SENIOR VICE PRESIDENT, OPERATIONS AND TECHNICAL SUPPORT AIR TRANSPORT ASSOCIATION OF AMERICA

Madam Chairman and members of the committee, my name is John R. Ralph, Senior Vice President, Operations and Technical Support of the Air Transport Association of America. Accompanying me today are Dr. C. Richard Harper, Vice President, Medical Services, United Airlines, and Dr. Robert L. Wick, Jr., Corporate Medical Director, American Airlines.

The Air Transport Association (ATA), which represents virtually all of the U.S. scheduled airlines, appreciates the opportunity to appear before the Subcommittee to present our industry's position with respect to Emergency Medical Equipment carried on airline aircraft.

The movement to require additional medical equipment on airline aircraft beyond that presently required by the Federal Aviation Regulations has been advanced by various individuals and organizations for the past several years. These efforts have, we assume, been based upon perceived problems in providing adequate emergency medical care of passengers while inflight. Let us look first at the scope of the in-flight medical emergency situation and then review airline methods of handling these emergencies.

If we define a significant airborne medical emergency as one which requires an unscheduled landing because of a medical program with a passenger, it turns out that this occurs about once for each 1,000,000 passengers carried by the U.S. airlines. Thus, it is obvious that significant medical emergencies experienced aboard U.S. airline aircraft are rare.

It would appear from the data that an inflight death has occurred, on average, once for every 6,500,000 passengers carried. Almost all the deaths that have occurred in flight have involved older individuals with previously known medical problems. A distressing number were traveling despite their own physician's contrary advice. Since the number of deaths that have occurred is so small, it is difficult to categorize them by type, and it is the airlines' view that an enhanced medical kit would not have assisted in preventing these deaths.

Let us now address airline methods of dealing with inflight medical emergencies.

All airline flight attendants are given initial training in dealing with inflight medical emergencies. Annual refresher courses are also a routine part of their training. While flight attendants are not registered nurses, they do work on the philosophy of relieving pain, maintaining or restoring consciousness and sustaining life until more comprehensive care can be obtained for the passengers. The training protocol is too long to list here, but it includes CPR and the "Heimlich" Maneuver as well as a number of other paramedical emergency actions. Aboard an airliner, there is usually at least one individual trained in CPR for each 35 persons.

Within the U.S. airspace our airplanes are rarely more than about 20 minutes from a point of emergency landing if necessary. Crew members can radio ahead, make an unscheduled landing, and have a passenger in the hands of medical personnel within 20 minutes. It would be difficult to match that in many metropolitan areas. Further, we find that frequently there is a physician on board the airplane and his or her advice can be solicited.

The first aid equipment carried on board our airplanes is specified in the Federal Aviation Administration Regulations, and it is essentially standard first aid equipment. We supplement that with other items we have found useful over the years. For example, most airlines carry oxygen, antacids, extra aspirin, bandages and other first aid items found almost universally.

The airlines transport about 800,000 passengers a day. In a group that large, there is bound to be an example of almost anything you can imagine. It is not practical to try and prepare for every medical contingency that might arise in flight. It is important to be prepared for the more common problems but no one can reasonably expect the airlines to be able to cope with all potential medical problems while in flight. That is the reason we emphasize getting the person experiencing a serious medical emergency on the ground as quickly as possible and into the hands of medical practitioners who are properly equipped to cope with the problem. The airline record in this regard has been excellent.

Madam Chairman, that concludes our prepared comments. We are now ready for your questions.

Senator INOUYE. Question No. 1 Are you satisfied that sufficient studies have been made in the matters we have discussed?

Mr. RALPH. It is very difficult to argue against a study. I realize that. But our views are that we ought to have a demonstrated prob-

lem to address, and we are not convinced that the evidence of jet operations and the carriage of passengers for the last 20 years has created a data base that shows us that there is a problem, either in terms of the quality of the cabin air, that has been addressed earlier, or in terms of the issue of the medical kit.

Let me make just one comment with respect to the medical kit. I am not a doctor, but I would like to represent the airline view with respect to one item, and that has to do with the precautionary landing. We believe that this is the most important and the most rapid means of getting an afflicted passenger under the care of competent medical personnel. Even if we had an enhanced medical kit with a doctor aboard, we would still land at the earliest possible opportunity in order to turn an afflicted passenger over to competent medical care on the ground, where the patient could be rushed to facilities appropriate for his needs.

Senator INOUYE. But General, if I might interrupt, what if you are flying across the Pacific?

Mr. RALPH. Well, perhaps the other doctors might have something else to address on that.

Senator INOUYE. But there is no other place to land other than Los Angeles or Honolulu.

Mr. RALPH. I will admit it is a long way between Los Angeles and Honolulu.

Dr. HARPER. Senator, I am Dr. Harper from United Airlines. Our airline and many of the other major carriers are considering at the present a medical kit, which is very hard to define because of the different specialties of medicine involved. But we are seriously considering that kit for a physician to use on our overwater aircraft.

But we do not, because of the rarity and because of what the general just said, we do not feel that such a medical kit on board domestic flights, where within 20 minutes, you can have the person in the hands of good paramedical personnel, that it would be worthwhile—in fact it would have more potential for misuse.

Senator INOUYE. Are you certain of the rarity that you speak of after listening to Dr. Dick, I believe it is, citing the Alaskan situation? Is it not possible that these occurrences are happening quite often and we are not aware of them?

Dr. HARPER. Well, I think if they were happening that often we would certainly be aware of them.

Senator INOUYE. Well, if a planeload lands at Dulles and everyone scatters to the 4 winds and I get the flu and 50 others on the plane get the flu and no one connects it to the aircraft, then we are not going to report that.

Dr. HARPER. That is possible. But in all my years of aviation experience, aviation medicine, I have never heard of anything other than this Alaskan situation, and there have been a lot of airplanes flying every day since 1959 with the advent of the jet aircraft.

It is hard for me to believe that the aircraft are serving as harborers of epidemics throughout this Nation, any more than buses or the train or any other means of transportation.

Senator GOLDWATER. What is the real gut reason? What is the bottom line? Why does United not want to spend a couple of hundred dollars for a medical kit? I cannot buy your arguments.

This idea that you can land anyplace, there is a lot to that, but there are a lot of airports in this country that you are not going to put a 747 or a DC–10 down on. And if you are out in the middle of the Atlantic or you are out in the middle of Asia, that is not going to work.

I am talking about digitalis, about nitroglycerin, something you put under a person's tongue and they can live.

Dr. HARPER. Well, contrary to some of the earlier testimony, I think the basic issue here is saving a life. And with the incidence of deaths in flight being on our airline 1 for every 6½ million passengers carried, and when you look at those deaths in a little greater detail, at least the detail which is possible, a significant number of these people who die in flight are going home to die. They are terminally ill people, and a significant number of them die and nobody knows they are dead until the plane lands, for example.

But the incidence is extremely rare. And I believe, many of the statements that have been said today are misleading. For example, Dr. Keshishian said that deliveries of babies in flight are very frequent. I would like to have his documentation for making such a statement, because I cannot recall in the domestic United States of an in-flight birth in the last several years.

Senator GOLDWATER. I do not buy that argument that it might only happen once in 10 years. We have medical kits on buses. Private aircraft have to carry them. We have them on private boats. We have medical attention on every means of transportation.

If you had a good argument I could buy it. But so help me God, I cannot buy an airline in this country saying, we do not want to put a medical kit on because nobody has ever died on our airline.

I will admit that the sicknesses—I have been flying airlines since 1927. I do not think I have ever seen anybody get sick on an airplane. But that does not mean that on the next flight there is not going to be somebody taken ill—it might even be me.

And I do not think arguing against a medical kit on an airplane, to be honest with you, makes any sense. And I would much rather see the airlines of my country voluntarily, without Government direction, provide at least a modicum of something that can relieve the passenger's discomfort and prevent death, even if it means prolonging death when you get the person on the ground. I just cannot buy it.

Dr. HARPER. Well, maybe Dr. Dick can support this. Most of the incidents that happen are in-flight medical emergencies, if that is what you want to call them, or incidents. Most of them are not death threatening, as evidenced by the low in-flight death rate. For example, let us take a person who is having chest pains. It has been our experience that when we have a medical incident on our flights, 35 percent of the time there has been a physician aboard.

You have to first consider that this physician may not be trained to handle the special equipment that Dr. Dick talks about or Dr. Keshishian is experienced in. He has as much potential in harming that person or causing his death as he does in helping him without more sophisticated medical equipment.

Senator GOLDWATER. But he can help the person.

Dr. HARPER. But I am saying that he has as much or more of a potential of harming that person or killing that person than he

does in helping that person, without more sophisticated medical equipment, for example, like an electrocardiogram.

Senator INOUYE. If you were in the doctor's position and you were a passenger on the plane, would you not have the good sense, if you did not have the proper equipment, to so indicate?

Dr. HARPER. What I am saying is, without the most sophisticated equipment you can make mistakes. Dr. Keshishian mentioned lidocaine. Some years past, lidocaine in an acute heart attack was recommended as the immediate drug of choice to give a person to prevent fatal irregularities in the heart. But there a divided opinion amongst the medical community now, and some people feel, and rightly so, that to give lidocaine initially can kill the person.

Senator INOUYE. So what is your recommendation? If I should be a passenger going across the Pacific and suddenly have a seizure and it is a heart attack, what can I hope for?

Dr. HARPER. What I am saying is that on our overwater flights, we are in the process of evaluating and developing a medical kit for physicians. But we feel that, for the reasons as stated in the prepared testimony, because of the rarity, because of the accessibility within 20 minutes, which would be hard to duplicate even in most metropolitan areas—within 20 minutes you could have the critically ill person in good medical hands.

Senator GOLDWATER. Well, let us forget that. The passenger gets on. The pressurization process of the aircraft, he suffers ear pain. Now, something should be aboard. We can say there is no oil, there is no ointment, there is nothing. I get a headache, I want an aspirin; there is no aspirin.

I am talking about helping. I do not necessarily expect death to be averted, if that is going to happen. But there are accidents aboard. You say you supply splints. I have seen them. They are not very big. You break your finger and you are in good shape. You have turbulence and you break your leg, and you are in bad shape.

I am just talking about simple, ordinary medical kits that can help a person who does not feel well.

Dr. HARPER. Well, I can assure you that United Airlines has these kits aboard.

Senator GOLDWATER. Well, I want to tell you, I flew on United a month ago and I specifically asked for two aspirin tablets and the girl told me there were none on board.

Dr. HARPER. Well, maybe they ran out. But they are supposed to be on board.

Senator, I would like to just add, it was mentioned earlier by Mr. Finucane that the first aid kits on board the aircraft only had band-aids and splints. And there are 10 items, first aid items, in the aircraft first aid kits. The kits vary in number, depending upon the size of the aircraft, from one to six. Ten items, including ammonia inhalants, antiseptic swabs, different sizes of bandages, triangular bandages in case of a fractured arm for a temporary splint, tape, et cetera.

So I do not want that misleading statement to go by. Dr. Keshishian said that these first aid kits were useless for any emergency.

Dr. KESHISHIAN. They are.

Senator GOLDWATER. Well, I will tell you, you had better get the word out, because I am flying West tomorrow morning. I want to

see that box on any plane I get on, and if I do not see it you are going to hear from me.

Dr. WICK. Senator, may I make a few comments? I am Dr. Wick from American Airlines.

I think we are confusing several issues here. There is a fundamental requirement, and as a matter of fact it is a dispatch requirement, that the first aid kits mandated by the Federal Aviation Administration be on board the airplane before it is dispatched. So although I cannot explain and I am at a loss to understand why a flight attendant would tell you there is no first aid kit on the airplane, I can guarantee you with 100 percent reliability that there was in fact a first aid kit, and the number and the size is a function of size of the airplane.

Now, I might comment that on American Airlines we recognize that there are problems which that first aid kit does not address, and we have on our airline a special kit which is called a flight attendant's service kit, and that has a lot of things in it, including decks of cards and other small amenities. But specifically included in that kit are things which we have found to be helpful over the years for problems just such as those you mentioned.

Specifically, there is extra aspirin, a good deal of it, in there. There are extra band-aids, a good deal of them. At certain times—and I am not sure whether they are on there at the present time or not, but we have in the past carried extra antacids for indigestion.

We also, of course, have milk normally on the airplane, and that will serve as a supplement or an alternative. We also carry medicines on board which are specifically for the relief of ear blocks and ear discomfort. And we carry these because experience has shown us over the many years that these will be necessary and will be helpful.

I might also comment that on our airline—and we have carried about 250 million people in the last year—we have had one in-flight delivery and that was about 10 years ago. Interestingly enough, just within the last month we had another passenger on board who was in fact in labor and we thought we might have to deliver another baby. And the girls on board our flight were very, very ingenious, and there are a lot of things which ingenuity will permit one to do on an airplane.

For example, these girls got a hair beret and they were going to use that for a clamp for the cord. Then they sterilized it in vodka, which is a waste of vodka to some extent, but it is nonetheless a very ingenious and effective way of sterilizing small items. They borrowed a Swiss army knife from somebody that they were going to use to cut the cord. And then they got the tablecloths out to set up a clean area for delivering the baby if necessary.

Fortunately, they were able to land and the lady went on to the hospital and there was no particular problem. But there are many things. There is ice on board the airplane. There are magazines, which can be used as splints. They make very fine field expedient splints.

I must say that, considering the fact that we run 10,000 flights in this airline industry every day in the United States, the number of incidents which occurs is quite small.

I would like to correct one other bit of information that has been put out here. It is true that many of the airlines of the Atlas group, the European airlines, that is Lufthansa, Sabena, and so on, do carry a medical kit. But they do not carry a kit on any flight which is within 90 minutes of a place of intended landing or a place of possible landing. So that in those cases when a kit is carried for use by a doctor if one is on board for a flight, that flight is likely to be an intercontinental flight.

I might also say that a colleague of Dr. Harper's and mine at one of the major airlines, probably the second or third largest in the world, tells us recently that in his experience with medicines aboard the kits there has been a terrible problem with pilferage. In fact, I think he said they carried valium and last year they replaced 43,000 valium tablets, and they were unable to identify a single one which had been given to a passenger.

That is unfortunately a sad but true commentary.

It was the case on American Airlines many years ago. When we first put the 747's into service we carried a doctor's kit. We finally took it off. It was really not used. The amount of times and the number of times it was used was virtually nil.

We can talk about the number of people who die. It is sad, it is unfortunate. It is also not at all assured that any medical kit that we could possibly carry on the airplane, up to and including making it a well-equipped hospital emergency room, would have made a great deal of difference in any of these cases.

You may remember the celebrated case of an associate, a fellow pilot, Randy Lovelace. I am sure that you remember when Randy had his unfortunate accident. It was also true that Randy was not killed in the accident. But had that crash occurred on the doorstep of George Washington University Hospital it would not have made any difference in the outcome. And that is often the problem.

As Dr. Harper mentioned, we have about one death for every 6 to 7 million people. We had an unscheduled landing the other day with one of our wide bodied aircraft, and the landing was for a lady who was trying to go home with terminal lung cancer. She did not make it.

Senator INOUYE. On the question of valium, on pilferage, who was in charge of those pills?

Dr. WICK. Those were put in the cockpit of the airplane and entrusted to the care of the captain.

Senator INOUYE. Was it under a lock?

Dr. WICK. I am sure it was.

Senator INOUYE. And 43,000 disappeared?

Dr. WICK. Those were the numbers reported to us, yes, sir.

Senator INOUYE. Well, I happened to be one of the patients on board an American Airlines, and this was 7 years ago, from here to the west coast. And my earache was so intense, I asked the stewardess—and incidentally, I can take pain. And she said, we have nothing.

When did you put the earache medicine on board?

Dr. WICK. About 4 years ago.

Senator INOUYE. Then I can understand why they did not have it at that time.

Do you think valium is much more important than the earache medication?

Dr. WICK. No, sir, I do not.

Senator INOUYE. What justified the availability of valium over other drugs which to me, as Dr. Goldwater here has indicated, would be much more appropriate? I am not a physician. Valium, I agree, I would not put valium on an aircraft.

Dr. WICK. As was mentioned here, we were considering a good samaritan law several years ago and there was testimony on Capitol Hill in front of a House committee by two doctors who had been involved with in-flight medical problems. One of them happened to be a psychiatrist and one of them happened to be an ENT man. The list of proposed drugs included many psychiatric drugs, and the list of proposed instruments included many of the ear, nose, and throat instruments. But neither one of them thought particularly much about any of the cardiac drugs.

So that the drugs and the medicines and the material which one would put on an airplane will vary widely. And as a matter of fact, I think if you asked the 400,000 doctors of the United States what they would put on, I expect you would get about 400,000 answers.

Senator INOUYE. Dr. Keshishian.

Dr. KESHISHIAN. I realize some of the remarks I make are not always acceptable to my colleagues, and I can understand why. Some time ago American Airlines published a list of emergencies experienced by travelers. They included 21 instances of syncope, which is fainting, 20 of heart attack, real or suspect, 20 of dyspnea, shortness of breath, including asthma and so forth. They listed three categories of unscheduled landings due to medical emergencies expressing illness as acute medical emergencies and exacerbations. It has been pointed out by Mohler and others that it takes sometimes at least an hour to land a large aircraft for an unscheduled landing. Very often, as was pointed out, they cannot always land at a given airstrip so that you are sometimes further away from help than you think you are.

Air France reported that out of 100 requests for physician passenger medical kits, they used the kit 56 times out of 100 requests. They had 14 heart attacks, 4 deliveries, including a hemorrhaging during a childbirth, and 10 attacks of kidney stones, just to go on to others. These were aboard 747's. The Air France medical kit is kept in the compartment. There is no problem getting it out. The first aid kit that is aboard the aircrafts today has not changed much from the one that they devised by Johnson & Johnson in World War I. This is all documented and is present in the statements and in the articles that Dr. Finucane has enclosed.

With all due respect to my colleagues in the airline medical departments, there is nothing wrong with using lidocaine when you have wild irregularities of the heart. It will not kill you as often as it will save you.

Senator INOUYE. Just a matter of curiosity, since I travel so much, where are the first aid kits on United Airlines and American Airlines, as I take both airlines?

Dr. HARPER. They are in the overhead bins, the ones that I have seen

Senator INOUYE. Where are they?

Dr. HARPER. In the overhead bins in different locations.

Senator INOUYE. In the front, the back?

Dr. HARPER. That depends upon the aircraft. Like I said, I think on the 737 we carry one, and then on the 747 there are six.

Senator INOUYE. And you are satisfied that that kit is sufficient for the operations of your airline?

Dr. HARPER. Except for the overwater flights which we have under consideration now for a medical kit. I feel, contrary, again, to Dr. Keshishian, that the 1 hour to land an airplane is the rare exception rather than the rule, as we have found it to be. We are willing to make a nonscheduled landing for a critically ill passenger at any time, even if there is no doctor aboard, any time that the captain or the crew along with the flight attendants deem that a person is critically ill. We can testify to that because 12 percent of our nonscheduled landings, the passenger either catches that same flight or reboards one a short time later.

Senator INOUYE. Is American Airlines also satisfied that the present medical kit is sufficient and appropriate for airline operations?

Dr. WICK. Well, Senator, as I mentioned, we were confusing terms here. We have a first aid kit which is required. It is seldom used, in all honesty. The other materials that we carry seem to fit the needs of our passengers.

Senator INOUYE. Dr. Almond, do you have any comment?

Dr. ALMOND. Well, let me say that in the 4 years that I worked with the FAA as a national medical advisory person, we had the opportunity to work with American, Pan Am, and the other medical directors, and I have a great respect for these people because I think they have a tough job and I think they do a good job, and I, like Senator Goldwater, would like to see the whole industry come forward, along with the—in concert with the FAA and take a look at the issues. I think there are a lot of things that could be done. I think that there is a lot of disease spread in cabins. We have all been affected by this. I think this research should be carried out effectively and independently, and then I think proper measures should be taken. I think the point of talking about the tremendous cost in this is really not correct. We all know that there are engineering design things coming forward constantly, and I think as far as the ability to take care of emergencies, I think we should be prepared to do this. I think the airplanes are getting bigger every day. We have got more passenger problems that are going to face us.

But as far as the airlines, I think they have been great. I think they have done a fantastic job, and I think the manufacturers are willing to face these problems, and I think these gentlemen that have the very difficult task of the medical personnel and the management of medical problems have done a great job.

Senator INOUYE. For the record, are the two doctors, the one from United and American, opposed to an independent study by the FAA?

Dr. WICK. Senator, I might comment on that. It is very hard to be opposed to any study, and the question really is in the national interest, if you will, can we study everything, and I say that in the broadest sense of the word. The answer, of course, is no, we cannot. So we must instead structure our priorities. Now, I am certainly

not opposed to any study for anything. There is a question, however, of whether we ought to be devoting what energies and the limited time and scientific talent that we have in this area to our other areas.

I would like to amplify Dr. Almond's remark for just a moment.

Senator INOUYE. Before you do that, do you believe that we have had enough studies?

Dr. WICK. I would comment that I suspect that the data we would like to have probably exists now. I think that a very careful and thorough search for that data will probably find us the answers that we are interested in.

Senator INOUYE. Have you found the answers?

Dr. WICK. No, sir, I have not. It is amazing to me the number of times one goes through a very expensive and involved study—and I might say that although I am with American Airlines now, for 10 years I was a full professor of preventive medicine at Ohio State University and Chairman of the Division of Environmental Medicine—it is amazing to me that in reviewing studies, the number of studies which were found which in fact repeated studies which had been done some years ago and which were buried in very obscure sources and very obscure literature. I would guess that probably one-third to one-half of the research done in the United States today is probably repetitious in that sense.

Dr. HARPER. Could I comment on that?

Earlier reference, Senator, was made of a joint FAA-NIOSH study which was published in 1971. NIOSH is, as far as I am concerned, a competent group, and the FAA is in most instances competent. It involved over 3,000 passengers in aircraft designated as Boeing 707, DC-8, 747, 737, 727, both the regular and stretch, DC-9, and BAC-111. This was a combination of Military Airlift Command charter flights in which there were 100-percent load factors, and the overall amount of smokers versus nonsmokers was approximately 60 percent. The things that were measured in the air were broken down into many different categories including carbon monoxide, the humidity, and tar products from the cigarette smoke. The carbon monoxide on these flights, which by the way were anywhere from 8 to 11 hours long, the carbon monoxide did not exceed 5 parts per million, the acceptable level in such environments being 50 parts per million. The relative humidity was 14 to 20 percent.

The conclusion of the study, which was entitled "Health Aspects of Smoking in Transport Aircraft," was that there were no health hazards.

Now, the study did lead to segregation of smokers from nonsmokers because the questionnaires given to the people indicated that was desirable. That study did lead to the segregation of smokers aboard commercial aircraft.

Senator INOUYE. Do you think that helps? I do not smoke, but usually on the last row of nonsmokers, right in back of me is a smoker, and he has got that wind tunnel on, and I get the full effect.

Dr. HARPER. Well, there have been some studies performed. They were inconclusive as to the health effects of secondhand smoke other than the fact that it is unpleasant and it stinks.

Dr. WICK. Senator, I might comment that as a physician I unequivocally am opposed to smoking by anyone, anywhere, any time, under any circumstances. I think it has absolutely nothing to recommend it. It is probably the largest public health epidemic problem we have in the United States today. It is probably the most expensive problem we have today. Nevertheless, in our society we permit people to do things to themselves as long as it does not seem to directly harm others.

There are some inconclusive studies in the literature today about the effects of what are called sidestream smoking, that is, the effect of smoke of another individual on someone like yourself. They are not clear. There is some evidence that if you live with a smoker over a period of 10, or 15, or 20 years, there are some deleterious effects on your own health. There is nothing in the literature today which would suggest that there is a significant hazard to a healthy individual from casual exposure to smoke in an airplane, albeit it is unpleasant.

I might add one other comment about the AMA's recommendation. We talked about that this morning with respect to medical kits, Senator, and the AMA added one comment which has not been mentioned which is a rather important one and I think has some application. They suggested that doctors, just as Dr. Keshishian said, who are interested and who think they may be called or who are willing to be called, should in fact prepare themselves with very small medical kits and drugs with which they are familiar, with which they are knowledgeable, and which they are ready to use and know how to use. There are many, many cardiac glycocides, for example, and it has been a few years since I have been in medical schools, and I would be hard pressed to remember today all of the names of all of the glycocides. I have reviewed the medical kits of many of the foreign carriers. The drug names are very strange. They might well be very familiar to an English physician or to a German physician or a French physician, but it would take a lot of head scratching on my part to figure out what those drugs are and what they are used for, so that an individual physician really is better advised to carry some small handful of things with him that he knows how to use.

The second point relates to the patients and the passengers, the passengers/patients, if you will. Almost never do we have a problem, a medical problem with a passenger who in effect is having an ab initio problem. Almost every passenger who has a problem has a known medical difficulty, and I think it would behoove any individual traveling with a known medical problem to carry medicines for himself or herself which would be useful in the case of an emergency. It is distressing the number of passengers who will tell us, for example, "Well, I am a diabetic but I put all my medicine in my suitcase."

Now, we in the airlines haul many, many bags. We lose a very small percentage of them, and unfortunately it may have been yours, Senator, and we apologize without even asking. But it is amazing to me the number of people who when they travel do not use a little bit of forethought and a little foresight for their own health and their own well-being and carry their medicines with them rather than placing them in their checked baggage.

Senator GOLDWATER. That is why we have doctors.

Dr. HARPER. I would like to make one more comment, because a lot of reference has been made to the foreign carriers, very briefly. I have spoken to the medical directors of Air France, Lufthansa, KLM. One of the reasons they decided to put the more extensive "doctor kits 'on board was because they fly many of their ex-colonials, their people from their previous colonies, home for medical treatment. They fly over vast distances of areas where there are no acceptable medical facilities available, or where the country may not be friendly such as Libya, for example. In this regard, it is almost like flying over water. That was one of the prime reasons why they have the medical kits on board, because they carry a tremendous number of very sick people on an aerostretcher or otherwise from remote areas to Paris or Holland for medical care.

Senator INOUYE. Well, we have had I believe a nice discussion here. I would like to thank all of the doctors for helping us.

All I can say is that from the testimony that I have heard, I am more than ever convinced that a study is justified, and I am with you on your medical kit, but the opposition, as you know, Senator, seems rather in-depth and powerful and it may be an uphill fight. But when the combination of Goldwater and Inouye get into the act, something usually happens.

Ladies and gentlemen, I thank you very much. It has been a most enlightening hearing. Thank you.

[Whereupon, at 1:35 p.m. the subcommittee adjourned subject to the call of the Chair.]

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

STATEMENT OF THE AMERICAN MEDICAL ASSOCIATION

The American Medical Association takes this opportunity to comment on the issues of mandating medical kits on commercial aircraft and on cabin air quality in such aircraft.

Medical kits.—In June 1981, the AMA initiated a study of the provision of emergency medical care to passengers aboard commercial airliners or aircraft. Specifically, the purpose of the study was to develop information on medical problems resulting from high altitude flight, potential effects on medical and surgical conditions and recommendations for care of medical problems that occur in-flight. The study was conducted by AMA's Commission on Emergency Medical Services. This AMA Commission has representatives from AMA, the American Academy of Family Physicians, the American Academy of Orthopaedic Surgeons, the American Academy of Pediatrics, the American Association of Neurological Surgeons, the American College of Cardiology, the American College of Emergency Physicians, the American College of Physicians, the American College of Surgeons, the American Hospital Association, the Americal Public Health Association, the American Society of Anesthesiologists, the University Association for Emergency Physicians, the U.S. Department of Health and Human Services, and the U.S. Department of Transportation.

The Commission's report was completed last December. In the course of preparing the report, the Commission met with medical representatives from several commercial airlines as well as officials from the Federal Aviation Administration (FAA) and the Aerospace Medical Association.

The Commission learned that the frequency of medical emergencies on commercial airflights is not significant. FAA does not have the authority to require that commercial airlines maintain records of in-flight medical emergencies or submit information that identifies the number and type of medical emergencies occurring aboard commercial aircraft. The FAA, however, has acknowledged that the incidence of reported medical emergencies aboard commercial flights is low. Available information indicates a death rate during commercial flights for the period 1976–79 of one person per 6.4 million revenue passengers with approximately one flight diversion for medical reasons for 10,000 scheduled flights.

In view of the available information regarding the low incidence of medical emergencies abroad commerical aircraft, the AMA believes that the first-aid kits currently carried aboard commercial aircraft are satisfactory. The AMA recently considered the specific question of whether the kit should include certain equipment and drugs. The AMA was concerned that the expansion of this kit to include potent drugs and surgical instruments could create a potential for misuse by unqualified persons during in-flight medical emergencies. We believe this potential for misuse outweighs any benefits that might be gained through the availability of such equipment in those infrequent occasions when its availability would be desirable. The AMA is also concerned about problems of out-dated drugs and potency problems if drugs are made part of the standard kit. the Commission's report concluded that the kits should not include surgical instruments or potent drugs.

The AMA has initiated efforts to inform physicians on how to care for in-flight medical emergencies so that they may respond appropriately if they are traveling on a plane during such an emergency. While the AMA recommends no changes in the present required aircraft medical kit, an article in the Journal of the American Medical Association (February 19, 1982) suggested what some physicians may wish to carry in a small first-aid kit in-flight. The Commission suggested that physicians who elect to carry a medical kit should include in it only those emergency drugs and instruments with which they are familiar from their usual practice. The article included a list of suggested basic drugs and equipment that may be considered for inclusion in a physician's personal kit:

Equipment: Stethoscope (aircraft noise severely masks heart sounds); oropharyngeal airways adult and child sizes; small flashlight with extra batteries; tongue blades; anaeroid sphygmomanometer (optional—convenient but not highly accurate at high altitudes); small bandage scissors.

Drugs (in ampules or preloaded syringes): Epinephrine hydrochloride; diazepam (Valium, oral and injectable); atropine sulfate; nitroglycerin (fresh); an injectable antihistamine (diphenhydramine hydrochloride); pseudoephedrine or nasal decongestant spray or both; an analgesic (pentazocine or codeine); and glucagon hydrochloride (optional).

A majority of commercial airlines annually conduct emergency medical training programs for flight attendants that range from four to twelve hours in duration covering first-aid and cardio-pulmonary resuscitation (CPR). This appears to be adequate. The AMA recommends that this pattern of educational programs be continued. the scope and length of this training should be determined by prudent medical judgment. On every flight there should be at least one flight attendant trained in CPR techniques equivalent to the standards of the American Heart Association, the american Red Cross, or other appropriate certifying organization.

The American Medical association will continue to inform physicians on how to care for in-flight medical emergencies aboard commercial aircraft. The AMA encourages physicians in active practice to respond to in-flight medical emergencies. Moreover, AMA has during the last two sessions of Congress supported "Good Samaritan" legislation intended to encourage physician response to such emergencies. This legislation would relieve health care professionals from liability otherwise arising out of emergency medical care furnished aboard commercial aircraft. We believe passage of such legislation will encourage physicians and other health care professionals to render emergency medical care when it is needed.

CABIN AIR QUALITY

The other issue on which the Subcommittee has requested comments relates to the quality of air in the cabins of commercial aircraft. S. 1770, pending before the Committee, would require the FAA to conduct an independnt study of various air cabin quality factors.

We note that S. 1770 would call for dissemination of information to the medical profession and the general public of current pressurization limits and practices to assure valid medical advice to travelers concerning the health effects of air travel. In this regard, we have attached to this statement for the information of the Subcommittee and others interested in this issue a copy of a February 1982 article from the Journal of the American Medical Association entitled "Medical Aspects of Transportation Aboard Commercial Aircraft." This article, prepared by the AMA's Commission on Emergency Medical Services, discusses the effect of air pressure changes on patients suffering from various disorders and discusses contraindications to air travel for certain patients. We believe this information may be useful to the Subcommittee.

While not a direct issue raised by S. 1770, the subject of cigarette smoking aboard aircraft is pertinent. In an April 10, 1981 statement to the Civil Aeronautics Board (CAB), the AMA discussed the hazards of cigarette smoke to non-smokers. The AMA recommended that studies be conducted relating to the health effects of passive smoke on airline passengers and that current airline standards not be relaxed. One option under consideration by CAB was total deregulation of smoking in aircraft. We stressed that such action could result in airlines actually retreating from the current standards of separating smokers from non-smokers. As an alternative to such an undesirable result, we stated that we would favor a total ban on smoking in all aircraft. A copy of our statement to CAB is enclosed.

SUMMARY

The AMA believes that the current first-aid kits aboard commercial aircraft are satisfactory given the infrequent incidence of medical emergencies aboard aircraft. We encourage physicians to assist in in-flight medical emergencies and encourage airlines to provide emergency medical training for their flight crews. The AMA is concerned about cabin air quality, particularly with regard to the effect of cigarette smoking on non-smoking passengers and submits the attached information for the record concerning medical aspects of commercial aircraft travel including medical aspects relating to cabin air quality and pressurization.

THE UNIVERSITY OF ARIZONA,
HEALTH SCIENCES CENTER,
Tucson, Ariz., June 2, 1982.

Hon. Nancy L. Kassebaum,
Chairman, Aviation Subcommittee, Committee on Commerce, Science, and Transportation, U.S. Senate, Washington, D.C.

DEAR SIRS: I am sorry not to have been able to appear at your hearing on cabin air quality (S. 1770), 20 May 1982. I think that there is a need to conduct an independent study to determine cabin air quality adequacy in regards to health and safety.

It appears quite likely that certain industry practices initiated to save fuel, especially those involving reductions in ventilation, may be dangerous to health. The increase in cabins of carbon monoxide, oxides of nitrogen, and particulates from such reductions are of great concern; passengers with cardiopulmonary problems would be at most risk to such increases. Ozone removal may be an additional factor of concern, specific to high-altitude aircraft. Some of these issues, as they are similar to other indoor pollution problems, have been addressed in the National Research Council report on Indoor Pollutants (1981), of which I was co-chairman.

I have noted several scientific articles on the subject of cabin air quality, including:

Bennett, G. Oxygen contamination of high altitude aircraft cabins. *Aerosp. Med.* 33:969-973, 1962.

Broad, W. J. High anxiety over flights through ozone. *Science* 205:767-769, 1979.

Browning, W. H. Deleterious effects of smoking and 100 percent oxygen on aircrew members in high performance aircraft. *Aerosp. Med.* 41:39-42, 1970.

Clamann, H., and R. Bancroft. Toxicity of ozone in high altitude flight. *Adv. Chem. Ser.* 21:352-359, 1959.

Daubs, J. Flight crew exposures to ozone concentrations affecting the visual system. *Am. J. Optom. Physiol. Optics* 57:95-105, 1980.

Jaffe, L. S., and H. D. Estes. Ozone toxicity in cabins of high altitude aircraft—a review and current program. *Aerosp. Med.* 34:633-642, 1963.

Lategola, M. T., C. E. Melton, and E. A. Higgins. Pulmonary and symptom threshold effects of ozone in airline passengers and cockpit crew surrogates. *Avait. Space Environ. Med.* 51:878-884, 1980.

Lategola, M. T., C. E. Melton, and E. A. Higgins. Effects of ozone on symptoms and cardiopulmonary function in a flight attendant surrogate population. *Aviat. Space Environ. Med.* 51:237-246, 1980.

Young, W. A., D. B. Shaw, and D. V. Bates. Presence of ozone in aircraft flying at 35,000 feet. *Aerosp. Med.* 33:311-318, 1962.

The issue appears complex and require careful deliberation of your committee. A panel of scientists, possibly under NRC auspices, might be of help in this endeavor. If I can provide further information, please let me know.

Sincerely,

MICHAEL D. LEBOWITZ, PH. D., FCCP,
Professor of Internal Medicine.

UNIVERSITY OF WISCONSIN,
CENTER FOR HEALTH SCIENCES,
Madison, Wis., June 3, 1982.

Rewording of letter of May 28, 1982

Mr. DAVID KIRSTEIN,
Commerce Committee,
Dirksen Senate Office Building, Washington, D.C.

DEAR MR. KIRSTEIN: I now have final counts and identifications on the bacteria which grew on the blood agar-containing Petri dishes I exposed May 19, 1982 during my stretch 727 flight from Chicago's O'Hare to Washington's National. During the flight I opened seven plates, three during the 40 minute period prior to takeoff and four during the 70 minute flight to Washington. When I testified before Senators Inouye and Goldwater the Petri dishes had incubated about 15 hours at body temperature (37°C).

Shortly after leaving your hearing I went to the airport where I remained until 7 PM; while at the airport I placed the dishes in a refrigerator to prevent organisms from growing which might replicate at room temperature. After arrival at Madison (10 P.M.), I placed the dishes at 37°C until the next morning, allowing approximatley 15 more hours incubation. Therefore there was a total 37°C incubation time of

approximately 30 hours. Following the second incubation, representative colonies were subjected to various identification procedures by Marcia (Mrs. Frank) Polyak in the General Bacteriology Section of the Wisconsin State Laboratory of Hygiene. The bacterium with by far the greatest predominance on all the cultures was a non-hemolytic, coagulase negative, catalase positive, gram-positive coccus consistent with identification as a member of of the genus Staphylococcus. This bacterium is ordinarily found on the skin and mucous memberanes of humans and animals. All staphylococci are considered potential pathogens, but the most consistently pathogenic staphylococci are usually coagulase positive; and none of the colonies tested by Mrs. Polyak had this characteristic. I have enclosed a brief description of the genus Staphylococcus from Lennette EH, Balows A, Hausler WJ Jr., and Truant JP, Manual of Clinical Microbiology. 3rd Ed: American Society for Microbiology., 1980, pp 83-87. (A standard textbook of clinical microbiology). There were several colonial types of staphyloccocci found on the plates which indicates that there were several species or subspecies.

Although the staphylococci were by far the most common organism found, also noted were Bacillus, Proteus and moulds (genus not determined).

The number of colonies on the plates increased markedly between the 15 and 30 hour incubation times. The colony counts of the seven Petri dishes by location within the aircraft cabin, by period of exposure and by period of 37°C incubation follow:

Plate 1.—Exposed before an individual seat air nozzle for ten minutes before takeoff: 15 hours incubation, 30 colonies; 30 hours incubation, 86 colonies.

Plate 2.—Swab specimen from the air nozzle streaked on agar in dish: 15 hours incubation, 0 colonies; 30 hours incubation, 72 colonies.

Plate 3.—Exposed on the seat next to me for 40 minutes before takeroff: 15 hours incubation, 20 colonies; 30 hours incubation, 117 colonies.

Plate 4.—Exposed during flight for three minutes in front of the air nozzle in the port stern head: 15 hours incubations, 3 colonies; 30 hours incubation, 157 colonies.

Plate 5.—Exposed to general atmosphere of port stern head: 15 hours incubation, 1 colony; 30 hours incubation, 54 colonies.

Plate 6.—Exposed in kitchen alcove during flight for 65 minutes: 15 hours inclubation, 10 colonies; 30 hours incubation, 35 colonies.

Plate 7.—Exposed on seat next to me during the 70 minute flight: 15 hours incubation, 30 colonies; 30 hours incubation, 127 colonies.

As I observed at the hearing, the cabin air is certainly contaminated with bacteria. Most of these bacteria are apparently staphylococcus organisms found on and in humans. As noted, there was a marked difference between the colony counts at 15 hours and at 30 hours. Probably the 30 hour figure is the accurate one, as it often takes a couple of days to get growth from airborne bacteria. Certainly, for example, the air vent sampled by swab (plate 2) is *not sterile;* no such surfaces are likely to be devoid of bacterial cells. On the other hand, there was a lot of condensation in the Petri dishes after refrigeration at Washington National. Sometimes this condensate can spread bacteria around a single plate. I would feel much more confident of the 30 hour counts if this condensate had not formed. Please be cautions in using the 30 hour incubation results; they are spectacular and need repreating.

If I can be of any further help to you or to the committee, please feel free to call on me. I certainly look upon commercial air flights with a different perspective then I did before I pursued this study.

Sincerely yours,

ELLIOT C. DICK, Ph.D.,
CHIEF, RESPIRATORY VIRUS RESEARCH LABORATORY,
Professor, Preventive Medicine.

UNIVERSITY OF WISCONSIN,
CENTER FOR HEALTH SCIENCES,
Madison, Wis. 53706, June 3, 1982.

Mr. PETER L. TRASK,
Senior Legislative Assistant, Office of U.S. Senator Daniel K. Inouye, Hawaii, Russell Office Building, Washington, D.C.

DEAR MR. TRASK: I enclose the final bacteriologic results from my May 19, 1982 flight from Chicago to Washington as a copy of a rewritten letter to Mr. David Kirstein. This June 2 letter is slightly reworded from a May 28 letter to him. I have sent Mr. Kirstein the rewritten original.

May 20 was first experience in testifying before a Senate Committee. I was quite surprised that Senators Inouye and Goldwater did their own questioning; I had expected that most of this would be done by counsel. It was, I think, much more effective for the Senators to do it. Both Senators obviously know enough about the subject to pursue pertinent and clear lines of questioning. Doubtless their knowledge resulted from briefs prepared by their legislative assistants!

I was mighty impressed by the importance of well-conducted congressional hearings as watchdogs. It seems to me that such hearings and resultant legislation are about the only way by which the citizenry can get at the gargantuan executive branch. I was very surprised at the cavalier and apparently ignorant attitude of the FAA representatives. They just didn't seem to be good public servants. It might be tempting to legislate a little reduction in the FAA budget to get these people "on the ball" or out of jobs. Perhaps President Reagan's efforts to simply reduce the number of federal employees has some merit, after all. I cannot imagine a good study of air quality coming out of any FAA-sponsored program. The results might be too embarrasing to the agency.

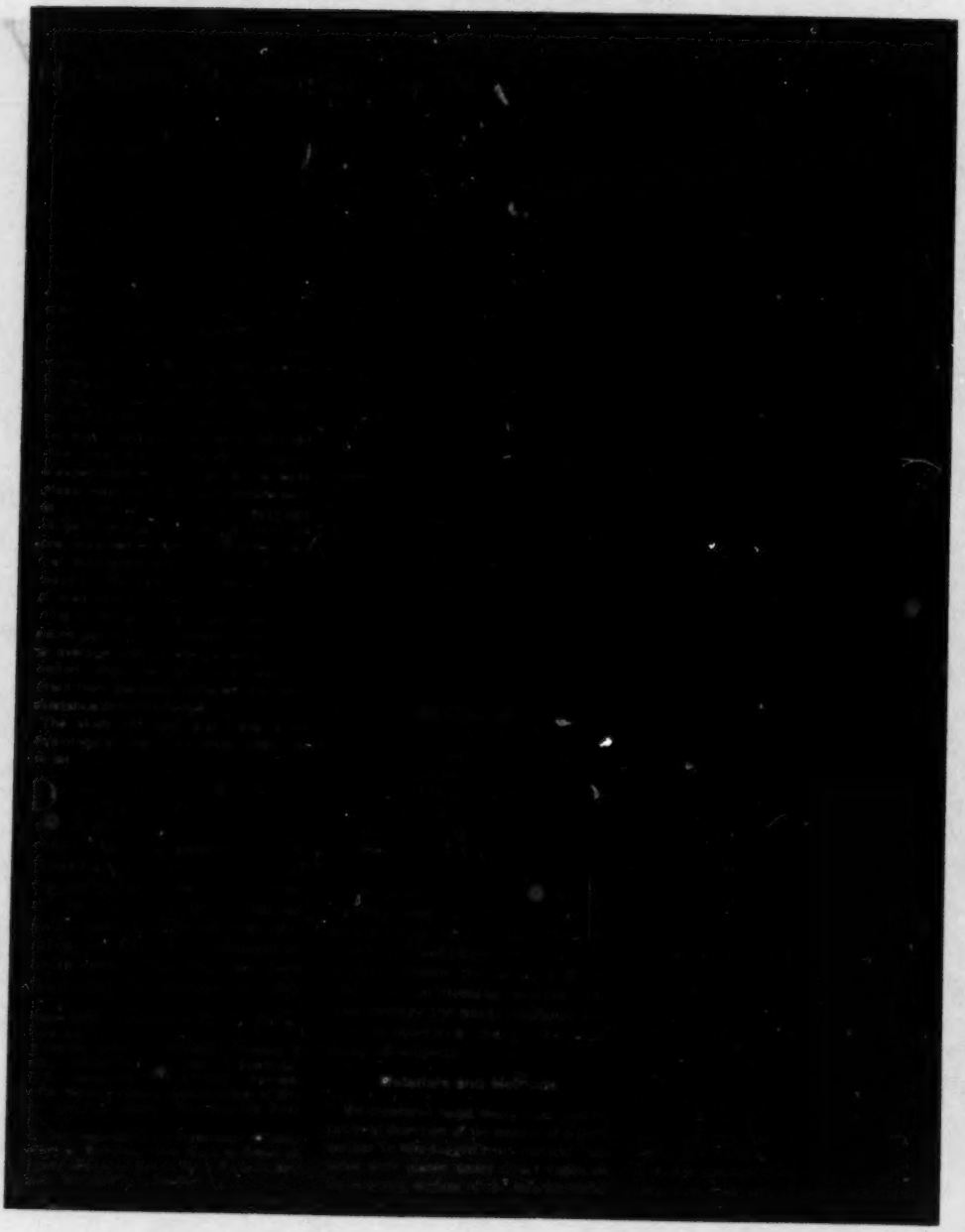
Very incidentally, I have two grown children who are admiring constitutents of Senator Inouye. My daughter Emily is a UH graduate and an accountant with Hyatt House of Honolulu and my son, Elliot Jr., is, at least for the present pumping gas. They are both great fans of Hawaii. I don't think I'll ever get them back to the cold Midwest!

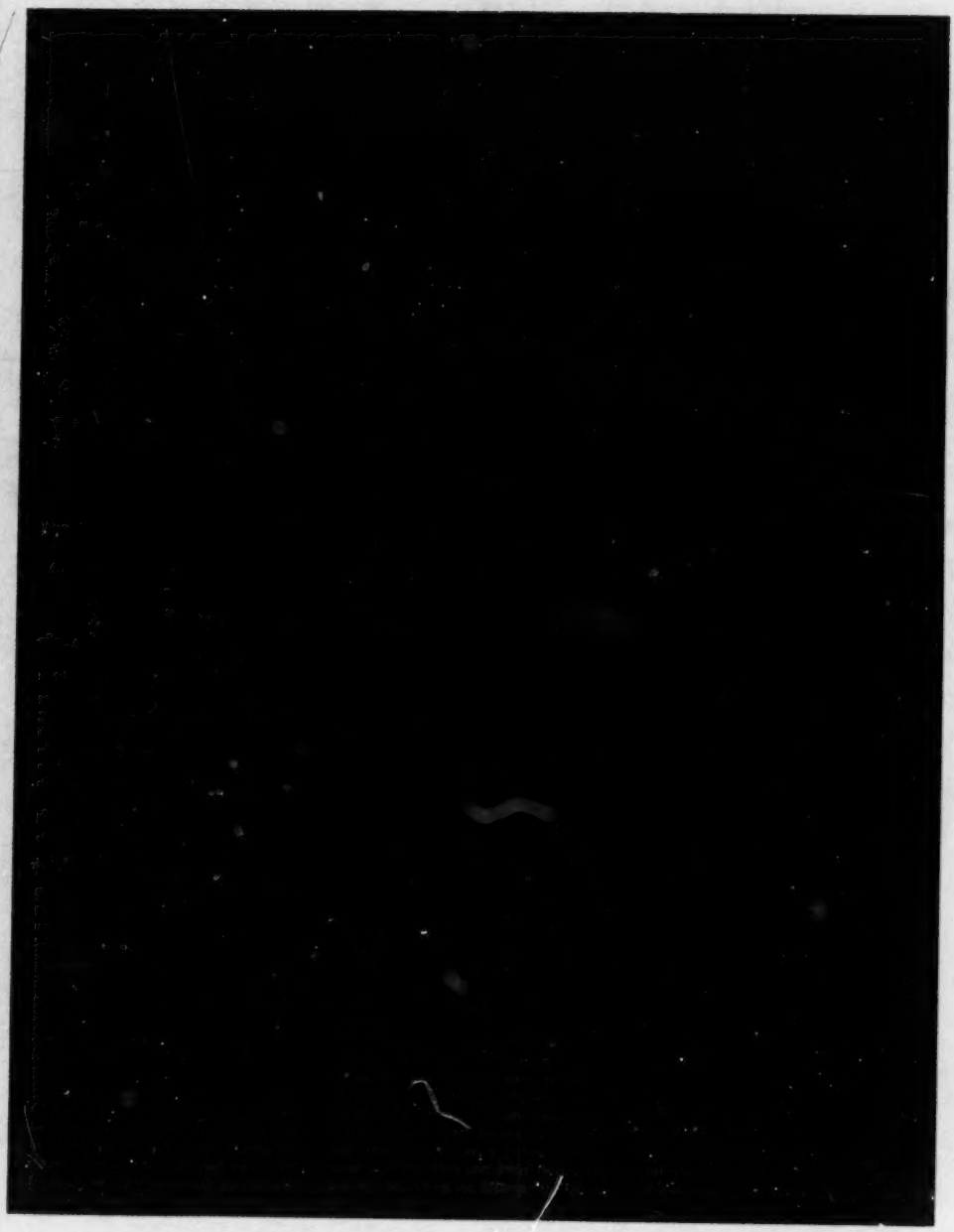
If I can be of further help, please call.

Sincerely yours,

ELLIOT C. DICK, Ph.D.,
Chief, Respiratory Virus Research Laboratory,
Professor, Preventive Medicine.

P.S.—I enjoyed talking with you on the phone. I was most interested in the dual role of the FAA in "supporting aviation" and looking after air safety. As we discussed, the airline industry certainly seems mature enough to promote itself without taxpayer help. It would seem appropriate to phase out the supporting function. I should think Wisconsin's Senator Proxmire might be interested in this money-saving device.





QUESTION OF SENATOR INOUYE AND THE ANSWERS [1] THERETO

Question 1. Previously, Xenex Corporation filed a petition for rulemaking to improve aircraft cabin air quality standards and in conjunction therewith maintained that the FAA promised to address the serious smoke and toxic fume issues in the event of inflight fires. In your testimony, you challenged the validity of the FAA denial of the Xenex petition, which the FAA and industry is claiming as proof that there is no need to improve the fresh air ventilation standards on board aircraft nor apparently the protection against smoke and toxic fumes. Do you concur with the FAA denial of the Xenex petition? If not, why?

Answer. No, we do not concur with the FAA Administrator's denial of the Xenex petition. The Administrator's actions in this regard are unfair, unacceptable and unjustified. In fact, it appears, and we believe this will be clear to the Senate Subcommittee on Aviation after we have completely answered this question, that the Administrator of the FAA is covering up many of the true facts surrounding the problems mentioned in the petition and related testimony. The Administrator has, in fact, ignored available information that indicates there are problems, in addition to wilfully withholding testimony provided to the FAA prior to the closing of comments.

The aforementioned testimony was hand delivered by the writer to the docket clerk at the Federal Aviation Administration, 800 Independence Avenue, Washington D.C. at 10 minutes before 5 PM, August 22, 1980. These comments were not considered by the Administrator in his denial of the petition. (See ex. N.) The Senators should be cautioned when reading the Exhibit that there is clearly a difference between the "Administrator" and the "FAA".

In our opinion, it appears to be a premeditated attempt to stonewall and obstruct the efforts to establish meaningful health and safety standards (where there presently, in many cases, are none whatsoever). For instance, in the question the Committee has presented is mentioned the fact that FAA and industry claim "there is no need to improve the fresh air ventilation standards on board aircraft nor apparently the protection against smoke and toxic fumes." This posture by the FAA and a handful of people in industry is preposterous and unconscionable. The fact of the matter is that there are no specific standards for fresh air ventilation in the passenger cabin on aircraft nor are there any standards, protection or instructions of what to do in the event of smoke and toxic fume emergencies on board aircraft as it concerns the occupants of the passenger cabin. Not only is the administrator's denial of the petition, but also the FAA's statements at the Senate hearing acts, that are in clear defiance of the FAA and the Administrator's duties under the Federal Aviation Act of 1958. To some, these words may appear strong, however, when the true facts are known, I think it will be clear to the Committee that these statements are, under the circumstances, charitable.

To wit, the Administrator says in the denial of the petition that the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) has established standards for ventilation of the passenger compartment on board aircraft. This is false. Attached hereto as Exhibit A is a letter from the Manager of Standards of ASHRAE which says "Confirming our telephone conversation, the recommended ventilation values given in Chapter 9 of ASHRAE Handbook 1978 Applications have not been standardized by ASHRAE. That is, they *have not been incorporated in one of our standards, particularly Standard 62, "Ventilation for Acceptable Indoor Air Quality"* which are arrived at by a consensus process." (Emphasis added) (See ex. D.)

As an apparent reason to deny the petition, the Administrator misstates the true language of the law in the Federal Aviation Regulations, implying that the law states that each crewmember on a plane "must have at least 10 cubic feet of fresh air per minute". This is false. Correctly, the relevant section of the Federal Aviation Regulations reads "25.831 Ventilation (a) Each passenger and crew compartment must be ventilated, and each crew compartment must have enough fresh air (but not less than 10 cu. ft. per minute per crewmember) to enable crewmembers to preform their duties without undue discomfort or fatigue." (Emphasis added) The Administrator's statement is an obvious attempt to mislead the readers to believe that there are regulations and standards for the occupants of the passenger cabin. This misstatement of the law by the Administrator was brought to his attention and that of the Chief Counsel of the FAA approximately two years ago. (See ex. G.)

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[1] A list of the exhibits and a brief summary that was attached to the answers appears at p. 160. The complete exhibits were too voluminous to be printed and are in the Committee files.

In regard to our petition we wrote directly to the Administrator to verify that the serious issues of passenger protection in the event of smoke and fire emergencies would be included in the petition. In response to our letter we were assured that the serious smoke and fire issues would also be considered under the petition. (See ex. B.) I will quote from the letter. "Dear Mr. Werjefelt . . . You asked if Federal Aviation Administration (FAA) consideration of your petition would include normal operating conditions as well as abnormal operating conditions, such as *smoke and fire.* Since your petition for rulemaking did address the ventilation rules, which include FAR 25.831(d), *Those requirements would be included in the FAA consideration of your petition . . .*" (Emphasis added) Not a word was mentioned of the smoke and toxic fume issue and protection for passengers in the denial of the petition, in spite of more than 3000 aircraft smoke, toxic fume or fire occurrences over the last five years, just in this country alone. Not to mention an estimated 600 fatalities due to asphyxiation in little more than a one year period, all on American made aircraft. This is yet another reason that we object to the callous denial of the petition.

The foregoing are merely some of the reasons why we do not concur with the Administrator's actions. Further our petition clearly delineated that a large portion of the problems surrounding the deplorable fresh air ventilation rates on board aircraft centered on practices of not operating all the installed equipment which, to begin with, when it is all functioning at 100% capacity, can only provide a marginal amount of fresh air ventilation (approxmiately ½ to ⅓ of the implied minimum standards for odor and some contamination removal from a survival (bomb) shelter!) The Administrator did not even consider this allegation. Instead, the Administrator proceeded to discuss "a review of the ventilating characteristics of the crew cabin in 7 current transport airplanes". In other words, the cockpit, along with a passing mention of the ventilating characteristics in the passenger cabin implying that they are 3 to 5 times the ASHRAE Standards for aircraft, which we have just proven to you do not exist. The ventilating characteristics the Administrator is referring to are the capabilities of all the installed equipment and, in fact, has nothing to do with whether or not the equipment is being properly operated, which was one of the main points of our petition. The petition states *"With the recent advent of the fuel crisis, however airlines have reduced the input of fresh air still further to between 5 and 7 cfmp for "fuel conservation measures".* (Emphasis added) By doing so, the relative humidity rises to a high of approximately 20% (almost all perspiration and expiration). In order that passengers have a feeling of reasonable ventilation, approximately 70% of the used air is "recirculated". In some cases, this recirculated air is filtered for small particles. The cockpit crew is, by a separate ventilation system, provided essentially 100% fresh air." The preceding petition statement is fact in the real world of air travel. Yet, the Administrator conveniently ignores the allegations of reduced fresh air ventilation on board aircraft as a fuel saving measure. Why? It is perhaps because what the petition states is true? We believe so. The facts are that the FAA is currently certificating aircraft with "economy mode" air conditioning systems, which when operated for their intended purpose, will provide from less than 4 cfmp to approximately 7 cfmp of fresh air per person on a 747 at maximum seating capacity. This is approximately ⅒th to ½₀th of the implied minimum health standards!! (See ex. D.)

Further, the generous ventilation rates (not all fresh air) that the Administrator claims in his statement appear to be carefully picked, hiding the fact that newer aircraft do not even have the capability of the older ones referred to in the denial of the petition.

These problems are further substantiated and supported by Dr. A. J. Clayton, MB, ChB, DPH, FFCM, FRCP(C), Director General, Laboratory for Centre for Disease Control in Ottawa, Ontario Canada, who has studied the matter of disease transmission in aircraft. I will take the liberty to quote portions of a recent communication from Dr. Clayton. (See ex. E.) ". . . it must be recognized that I was informed that there was a total air change in the passenger cabin every 2-3 minutes, when under pressurization and I have no reason to suppose that this was incorrect. My conclusions were, however, at this rate of air exchange, that there was a significant risk to other passengers of acquiring a highly transmissible disease. . . My studies also addressed less transmissible diseases such as influenza, Chickenpox, and other airborne transmitted diseases." The "air change in the passenger cabin every 2-3 minutes" directly implies that all systems for ventilating the passenger cabin of aircraft were working at full capacity, even though the aircraft may not have been fully occupied. Thus, during Dr. Clayton's test, the pro rata per person fresh air ventilation rates would most likely have been in excess of 20 cfm!" Dr. Clayton concludes "In essence then I would support *from an epidemiological and microbiological point of view, your contention that there is a risk for transmission of disease in passenger air-*

craft, particularly when ventilation rates are at level of 4 to 7 cubic feet per minute." (Emphasis added)

Summarily, aside from the false statements, almost every paragraph in the Administrator's denial of the petition is either a misstatement of fact, or an inaccurate representation as it concerns the issues raised in the petition. In some cases, as we have pointed out, the allegations in the petition are not even addressed.

The foregoing are some of the reasons why we do not accept the Administrator's action. We do not believe his denial of the petition is in the best interest of the nation, its industry or the traveling public, let alone the credibility of the FAA Administrator and many of FAA's loyal and hardworking, dedicated employees.

Although the preceding facts amply demonstrate what we believe is callous negligence or incompetence by the Administrator, following is a more detailed account of our critique and objection to the FAA action vis-a-vis our petition. First of all, the heading of the Denial states "In the matter of the petition of XENEX CORPORATION to amend Sections 25.831 and 121.219 of the Federal Aviation Regulations". This is not correct. Our petition reads "Petition for Federal Aviation Administration, U.S. Department of Transportation, Rule Making. Scope: Federal Aviation Regulations Parts 25,121 and others as deemed applicable. Issues: Crew and public health—airplane cabin air quality standards. Contamination limits, fresh air ventilation and humidification requirements." Further, as it concerns proposed rules we stated "It is proposed that Par. 121.219—Ventilation be deleted and replaced as follows: Par. 121.219 Cabin Air Quality Standards. . .". However, prior to this we clearly state "Proposed Rules: "Petitioner recognizes that relevant industrial organizations involved in aviation, as well as employee unions of these industries, along with state and federal agencies and professional associations, will contribute to the final formulation of acceptable regulations pertaining to fresh air ventilation, humidity and contamination limits.

The rules proposed herein are of a basic and preliminary nature taking the aforementioned fact into account. In all likelihood, due to the unique and very congested nature of the aircraft environment, the ultimate regulations may have to be more stringent in order to properly address basic health, safety and comfort standards for crew and public." It is, therefore, clear that the matter of our petition as the Acting Administrator says to only amend Sections 25.831 and 121.219 is incorrect. Our petition merely used these paragraphs as a starting point. Based on the subject matter and the scope of the petition as stated by us, it concerns "Federal Aviation Regulations Parts 25.121 and others as deemed applicable". Further the petition states, "Issues: Crew and public health—airline cabin air quality standards. Contamination limits, fresh air ventilation and humidification requirements." I believe it is apparent to anybody who cares to read the petition in its proper light that the Administrator did not properly address the scope nor the issues of the petition in his denial of same.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 1, PAR. 1

"By letters dated May 8 and May 23, 1980, Bertil Werjefelt, President, Xenex Corporation, 1400 Kapiolani Blvd, Suite C-4, Honolulu, Hawaii 96814, petitioned the Federal Aviation Administration (FAA) to amend SS 25.831 and 121.219 of the Federal Aviation Regulations (FAR) to improve airplane passenger and crew compartment air quality standards."

XENEX CORP. COMMENT—DENIAL OF PETITION—PAGE 1, PAR. 1

Again, as just stated the Xenex petition clearly concerns all relevant sections of the Federal Aviation regulations, not just Paragraphs 25.831 and 121.219. Xenex Corporation merely suggested amendments of these as a starting point. This is quite clear from the petition itself. Further, it was not just a matter of improving standards. There are in many cases, NO standards or regulations, contrary to what the FAA is attempting to make the reader believe. So the petition also sought to establish standards and/or regulations.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 1, PAR. 2

"Section 25.831 states, in pertinent part, that each passenger and crew compartment must be ventilated and that each crewmember must have at least 10 cubic feet of fresh air per minute. Also, passenger and crew compartment air must be free of harmful or hazardous concentrations of gases or vapors. Maximum permissible concentrations of carbon monoxide and carbon dioxide are specified."

XENEX CORP. COMMENT—DENIAL OF PETITION—PAGE 1, PAR. 2

The statement by the Administrator" . . . that each passenger and crew compartment must be ventilated and that each crew member must have at least 10 cubic feet of fresh air per minute." is false. There is no such requirement in Par. 25.831 (see ex. O) of the Federal Aviation Regulations (FAR) nor is there any such requirement anywhere else in the FARs for that matter. FAR 25.831 was correctly quoted in our petition and it states, among other things, that: *"Each crew compartment* (emphasis added) must have enough fresh air (but not less than 10 cfmp of fresh air per crewmember) . . .". There is a big difference between the correct law versus the (wilfull) misquote by the Administrator. This regulation has little or nothing to do with real life. All it means is that an aircraft which is certificated under Part 25 of the FARs (which is virtually every jetliner in use today) must be designed so that each crew compartment wiil have the capability of supplying not less than 10 cfmp of fresh air for each occupant of the crew compartment. The only crew compartments that are common on airlines today are the cockpit and, on wide-bodied aircraft, the downstairs galley. What about the rest of the crew? The Administrator's seemingly wilful misstatement of the law clearly implies that all crew members on an aircraft "must have at least 10 cfmp of fresh air per minute.". That statement is not true. Moreover, even if it had been true and if instead of "10 cubic feet of fresh air per minute" it had been 100 cubic feet of fresh air per minute, all this paragraph refers to is design capability. In actual practice, when flying on board an airliner, current regulations (actually the absence of any meaningful regulations) permit that most crew members be supplied, for instance, 3, 4 or 5 cubic feet of fresh air per minute. How is this possible? This is possible because there are no FAR operating rules that dictate a minimum requirement, for occupants of the passenger cabin.[1]

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 1, PAR. 3

"Section 121.219 states, in pertinent part, that passenger and crew compartments must be suitably ventilated and fuel fumes may not be present and also specifies a maximum carbon monoxide concentration of one part in 20,000 parts of air."

XENEX CORP. COMMENT—DENIAL OF PETITION—PAGE 1, PAR. 3

One part of carbon monoxide in 20,000 parts of air equates to 50 parts per million. This is more than 5 times higher than the standards established by the Environmental Protection Agency. (See ex. P.) Further, Par. 121.219 states (see ex. O) "Passenger and crew compartments must be suitably ventilated . . ." The very essence of our petition is trying to define what suitably ventilated means. We contend that current practices and the absence of any standards or regulations does not provide for a suitable ventilated aircraft.

That is very clear in the petition. We contend "suitably ventilated" means meeting minimum health and ventilation standards.

Aside from this, we believe this section of the FAR's does not even apply to the current airtransport fleet rather, it is intended for antiquated aircraft such as DC-3's![2] If this is the case, then there are NO meaningful operating standards or regulations in effect! If one refers to the design regulations under FAR 25.831 one finds the words "suitably ventilated" have been changed to "ventilated". Suitably ventilated would imply enough fresh air to keep people alive, but what specifically does ventilated mean? Regardless of what it means, it is a moot issue because there are NO meaningful operating regulations.

For the FAA to state that "standards for air quality are satisfactory", is, under the circumstances, preposterous.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 1, PAR. 4

"In support of its petition, Xenex Corporation (Xenex) presents a number of arguments which are disscused in the following paragraphs."

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[1] Passengers and cabin crew on a wide bodied jet comprise more than 99% of the occupancy capacity of the aircraft.

[2] See Xenex testimony presented at May 20 hearing

XENEX CORP. COMMENT—DENIAL OF PETITION—PAGE 1, PAR. 4

The Administrator didn't even consider the majority of our comments, as for that matter, all the rebuttal arguments that we provided (at the urging of the FAA) prior to his decision.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 2, PAR. 1

"The petitioner contends that crew and passengers are subjected to health hazards while flying as a result of inadequate ventilation. In addition, fresh air ventilation rates on board airplanes carrying passengers are only 10 to 20 percent of the "fresh air ventilation" required by law for minimum acceptable indoor air quality in a nonaviation environment. The petitioner does not substantiate the health hazards to which it believes the crew and passengers are being subjected, nor does it provide information regarding the extent of the health problems being encountered. The petitioner does not explain how it arrived at the conclusion that passenger-carrying airplane ventilation is only 10 to 20 percent of that required by law for nonaviation environments. The petitioner also fails to identify the law to which the reference is made."

XENEX COMMENT—DENIAL OF PETITION—PAGE 2, PAR. 1

Contrary to the statements by the Administrator in Paragraph 5 of Page 1 of the Denial of the Petition, the petitioner provided ample documentation in the petition itself that the fresh air ventilation practices on board aircraft are only 10–20% of the requirement in the non-aviation environment. This is detailed in the petition under the headline "Public Health Rules and Regulations". The Administrator should obviously be aware that many, or almost all, aircraft in operation have reduced their fresh air ventilation, in many cases, to only 5 to 7 cfmp to "save fuel". Moreover, he should be aware of these low fresh air ventilation rates because they have certainly certificated many aircraft which are designed to provide this quantity of fresh air. Given the occupancy density on board an aircraft and the per person available volume for dilution, it is clear that the statements made by petitioner in the petition were, if anything, very conservative. Further, it is a fact that the cockpit is provided 100% fresh air and in some cases, in excess of 150 cubic feet of fresh air per person per minute which, in some cases, translates to in excess of 80 air changes per hour. This is done for health and safety reasons. (See ex. D–F, J–K, and P–S.)

Considering the fresh air ventilation rates (regardless of law) for the cockpit, which have been established for health and safety reasons, it is beyond the comprehension of the petitioner how the Administrator will use as one of the excuses for denying the petition that "the petitioner does not explain how it arrived at the conclusion that passenger carrying airplane ventilation is only 10% to 20% of that required by law for non-aviation environments." (The petitioner did not say airplane ventilation, the petitioner said airplane fresh air ventilation.) The implied minimum outdoor air requirement extrapolated from the ASHRAE Standards and Industrial Ventilation, neither of which anticipate the extremely high occupancy densities found on aircraft clearly point to a minimum of 40 cu. ft. of outdoor air per person per minute in order to provide for some contamination and odor removal (see Exhibit D). Incidentaliy, the 40 cu. ft. min. is for an underground safety (bomb) shelter. Further, the Administrator says "The petitioner does not substantiate the health hazards to which it believes the crew and passengers are being subjected, nor does it provide information regarding the extent of the health problems being encountered." First of all, petitioner did substantiate health problems being encountered, some of them of a lethal nature. Some of this material the petitioner (living in Honolulu) personally hand delivered to the Docket Clerk in Washington, D.C. 10 minutes before 5:00 PM on August 22, 1980, which was before the official closing of the comments to the petition. The petitioner has a signed statement (see ex. N) from the Receiving Clerk to this effect. However, the Administrator, as is evident from communications with the FAA, chose not to include these comments when he rendered his denial of the petition. Some of these substantiations of the health hazards, which are included in the August 19 letter to the FAA, clearly delineated matters that the FAA already knew, for instance, that the pilots were having respiratory problems due to bad air 30 years ago and the problem was corrected. So, for the Administrator to state that "The petitioner does not substantiate the health hazards to which it believes crew and the passengers are being subjected . . . is not only ludicrous but false. The Administrator knew of the problems, contrary to his statement if, from nothing else, from the material supplied by the petitioner, (and, of

course, more recently from the May 20, 1982 hearings testimony provided by Dr. Elliot Dick).

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 2, PAR. 2

"Xenex claims that the ventilation recommended by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) for indoor nonaviation environments should apply to passenger transport aircraft. The petitioner fails to explain why another ASHRAE standard which contains recommended ventilation 1 standards for passenger transport aircraft should not be used. ASHRAE 1978 Applications Handbook, Chapter 9—Aircraft, states in part, "A portion of the cabin air may be recirculated, but it should be filtered and purified if it is a large percentage of total ventilation or unless it is recirculated for limited times only. The recommended ventilation rate is 2.4 liters per second (l/s) per passenger and 14.2 l/s for cockpit crew members." The recommended ventilation rate of 2.4 l/s equates to approximately 5 cubic feet per minute (cfm), and 14.2 l/s is approximately 30 cfm. The current rule requires for each crewmember a minimum of 10 cfm of fresh air plus additional ventilation to perform his or her duties without undue discomfort or fatigue. A review of the ventilating characteristics of the crew cabin in seven current transport airplanes reveals that the minimum ventilation rates vary from 70 to 150 cfm per crewmember with air changes ranging from 20 to 87.8 per hour which exceeds the ASHRAE recommendation.

XENEX COMMENT—DENIAL OF PETITION—PAGE 2, PAR. 2

Again, this paragraph appears to be a willful effort by the Administrator to mislead the reader. The fact that the Administrator cannot even correctly quote the law attests to either willful deceipt or gross incompetence. For instance, the Administrator says "the current rule requires for each crewmember a minimum of 10 cfm of fresh air plus additional ventilation to perform his or her duties without undue discomfort or fatigue." We have previously proved that there is no such rule that applies to each crewmember. More importantly, there is no such rule in the operating rules of the Federal Aviation regulations. Referring to the "10 cfm of fresh air" that the Administrator mentions, this is merely a design requirement for a cockpit or downstairs galley. It is not a design requirement for a passenger cabin nor is it an operating requirement for the airlines to provide 10 cfmp for the crewmembers in the passenger cabin, nor the passengers for that matter.

In addition, the Administrator quotes an ASHRAE Standard for passenger transport aircraft. There is no such standard! The ventilation rates that are quoted by the Administrator from the "ASHRAE 1978 Application Handbook, Chapter 9—Aircraft" are, in fact, from a paper written by a Boeing Co. employee and one other person whose affiliation is not identified. The suggestions by these individuals have not gone through the cnsensus process of ASHRAE nor have they been reviewed and accepted by the ASHRAE Standards Committee. To imply, as the Administrator does, that there are "ASHRAE Standards for passenger transport aircraft" is false.

Again, a letter from Mr. G. F. Hohn, Manager of Standards, American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) dated June 18, 1982 addressed to the writer states ". . . the recommended ventilation values given in Chapter 9 of ASHRAE Handbook 1978 Applications have not been standardized by ASHRAE. That is, they have not been incorporated in one of our standards, particularly Standard 62, "Ventilation for Acceptable Indoor Air Quality which are arrived at by a consensus process."

The Administrator further says that: "A review of the ventilation characteristics of the crew cabin in seven current transport airplanes reveals that the minimum ventilation rates vary from 70 to 150 cfm per crewmember with air changes ranging from 20 to 87.8 per hour which exceeds the ASHRAE recommendation.

The Administrator failed to make it clear that the crew members he is referring to are pilots and that "the minimum ventilation rates" of 70 to 150 cfm per pilot is 100% fresh air. Incidentally, with reference to the Administrator's statement that the air changes for the "crew cabin" ra[illegible] up to 87.8 per hour, it may be interesting for this committee to note that sever[illegible] decades ago researchers in the medical community published data stating that 75 to 100 air changes [1] per hour would effectively control the transmission of many kinds of respiratory infections, so one can only question whether the air changes in the cockpit are a fortuitous coincidence or

[1] See Exhibit S, R as well as reference "Archives of Environmental Health"—air conditioning and health, Edward C. Riley, M.D., Richard L. Riley, M.D., vol. 7 Sept. 1963.)

by design and requirements as previously stated by researchers at Lockheed. What about passengers and cabin crew?

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 2, PAR. 3, 4, 5

"Xenex proposes fresh air ventilation at 35 to 65 cfm/person. The petitioner does not provide justification for such large quantities of fresh air flow. For buses and trains, the ASHRAE indicates that 20 to 24 percent outdoor air is adequate. Even using the minimum recommended ventilation for cocktail lounges (30 cfm/person) as an appropriate standard for transport aircraft, it would require only 6 to 7½ cfm/person of fresh air rather than 35 to 65 cfm/person as proposed. The petitioner proposes that filtered recirculated air shall never exceed 7 cfm/person. No support for this proposal is included in the petition.

"A review of the ventilating characteristics of seven current transport airplanes reveals that the ventilation varies from 15.2 to 25.7 cfm/person in the passenger cabin or 3 to 5 times that recommended by ASHRAE. When cabin air is recirculated in these airplanes, appropriate air conditioning is accomplished.

"The petitioner proposes that uncontrolled aircraft leakage be less than 20 percent. The proposal is not clear because the petitioner does not indicate what criteria requires that the leakage must be less than 20 percent."

XENEX COMMENT—DENIAL OF PETITION—PAGE 2, PAR. 3, 4, 5

At this point, I believe it should be clear to this committee that the credibility of the Administrator of the FAA should be seriously questioned. Nevertheless, lest there by any doubt, I shall continue my response to the preposterous assertions that are made by the Administrator.

The Administrator says on Page 2 Par. 3 that "Xenex proposes fresh air ventilation at 35 to 65 cfm/person. The petitioner does not provide justification for such large quantities of fresh air flow." Considering the true facts that I just presented in my prior statement herein, the Administrator's statement is ridiculous. In fact, literature that is several decades old supports the justification for "such large quantities of fresh air flow".[2] Not only that, the fresh air ventilation rates in the cockpit, in other words, in the Administrator's own back yard, supports the fact that our statement of 35 to 65 cfmp of fresh air for passengers and crew members is, if anything, a conservative and perhaps inadequate amount. The outdoor air requirements from a bombshelter(!) are at least 40 cu. ft. per person per minute for an equivalent per person airspace. Presently, as stated in the petition, fresh air ventilation rates on aircraft are commonly between cubic feet per person per minute.

To go on to the matter of businesses and cocktail lounges and recirculation of air, the current ASHRAE Standard 62-1981 "Ventilation for acceptable indoor air quality" shows that the outdoor air requirement for a cocktail lounge where smoking is permitted, is 50 cubic feet per person per minute—not 7½(!) as stated by the Administrator. (See exs. D and F.)

Nowhere is the public confronted in such a captive manner as on an airplane, in some cases, for extended periods of time. The cabin pressure is reduced from what people are normally used to, resulting in a lower tolerance to carbon monoxide and carbon dioxide, etc. For the Administrator to imply that the poorly or unfiltered air in the passenger cabin of an aircraft should be allowed to be recirculated is completely out of order.

The gratuitous assertion by the FAA that fresh air ventilation on board airliners compares favorably to the minimum ASHRAE standards is not true. Current practices on board aircraft are in many cases, not even ⅛th of the minimum recommendations for a bombshelter(!) let alone the ASHRAE standards for cocktail lounges, restaurants, offices, etc.! (See exs. D and F.)

The evidence as to what the appropriate fresh air ventilation rates should be, based on health and safety criteria, is evidenced in the cockpit. As it concerns the recirculation of cabin air, the 7 cfm/person limitation mentioned in the petition was, as stated in the petition, a proposal "of a basic and preliminary nature". The petition goes on to state "In all likelihood, due to the unique and very congested nature of the aircraft environment, the ultimate regulations may have to be more stringent in order to properly address basic health, safety and comfort standards for crew and public." At this point in time, with the overwhelming evidence attesting to the deplorable standards and practices and for that matter, the testimony presented by Dr. Elliot Dick, where 72% of passengers aboard an aircraft, with next to no

[2] Ibid. Exs. E and F.

fresh air ventilation, were contaminated by influenza. I think it is clear that recirculation should never be permitted at any time. This fact is further substantiated and supported by Dr. A. J. Clayton, MB, ChB, DPH, FFCM, FRCP(C), Director General, Laboratory for Centre for Disease Control in Ottawa, Ontario Canada, who has studied the matter of disease transmission in aircraft. I will take the liberty to quote portions of a recent communication from Dr. Clayton. ". . . it must be recognized that I was informed that there was a total *air change in the passenger cabin every 2-3 minutes,* when under pressurization and I have no reason to suppose that this was incorrect. My conclusions were, however, *at this rate of air exchange, that there was a significant risk to other passengers of acquiring a highly transmissible disease. . . . My studies also addressed less transmissible diseases such as influenza, Chickenpox, and other airborne transmitted diseases."* (Emphasis added) The "air change in the passenger cabin every 2-3 minutes" directly implies that all systems for ventilating the passenger cabin or aircraft were working at full capacity, even though the aircraft may not have been fully occupied. Thus, during Dr. Clayton's test, the pro rata per person fresh air ventilation rates would most likely have been in excess of 20 cfm!

Dr. Clayton concludes "In essence then I would support *from an epidemiological and microbiological point of view,* your contention that *there is a risk for transmission of disease in passenger aircraft, particularly when ventilation rates are at level of 4 to 7 cubic feet per minute."* (Emphasis added)

Again, the evidence attesting to problems, in this case that have been corrected, is apparent in the generous (from 70 cfmp to more than 150 dfmp) 100% fresh air ventilation requirements for the cockpit which is for health and safety reasons.

The Administrator says we have not provided justification for the proposed ventilation rates. This is not true. Petitioner has provided justification for the nominal fresh air ventilation rates of 35 to 65 cfm/person in the passenger cabin. Since virtually no recirculated air on the aircraft is properly filtered, recirculation is not permitted. (See exs. D and F.) So, for the FAA to discuss the merits of recirculation is out of the question. If the cockpit requires from 70 to 150 cfmp or as stated by a researcher at Lockheed, 100% fresh air and since this information was available to the Administrator, ample justification for these quantities of fresh air flow were provided by the petitioner.

In addition, petitioner provided justification by virtue of ASHRAE and other health and safety standards mentioned in the petition. Had the Administrator bothered to call ASHRAE or petitioner he could have received a draft copy of the 62-1981 "Ventilation for Acceptable Indoor Air Quality" Standard. If he reviewed this material he would have found that the outdoor air requirements for a cocktail lounge is 50 cfm/person. At maximum occupancy density of 100 persons per 1,000 sq. ft. of floor area. Assuming an average ten foot ceiling, this then provides for 100 cu. ft. of air space per person. On an aircraft the available air space per person is sometimes less than 35 cu. ft.!!! At 100 cu. ft. of air space per person for a cocktail lounge the minimun standard is 50 cu. ft. of outdoor air per person. The smaller air space the greater the need for outdoor air. Thus, it should have been apparent that 35-65 cfmp of fresh air suggested by petitioner may, in fact, not be enough!

The Administrator goes on to say ". . . that the ventilation varies from 15.2 to 25.7 cfm/person in the passenger cabin or 3 to 5 times that recommended by ASHRAE. When cabin air is recirculated in these airplanes, appropriate air conditioning is accomplished." First of all, there is no such ASHRAE standard. Second, I would challenge the Administrator to submit that appropriate purification and filtration of the recirculated air is accomplished on all aircraft to even permit recirculation. Third, our petition concerns "fresh", "outdoor air ventilation". Fourth, the 15.2 to 25.7 cfm/person may be a design criteria on some aircraft, however, the petition clearly points out that current practices by the operators of the aircraft are to provide only 5-7 cfm/person of fresh air—the Administrator cavalierly ignores this fact! (For a bomb-shelter it's 40 cfmp!)

As it concerns uncontrolled aircraft leakage, the Administrator says "The proposal is not clear because the petitioner does not indicate what criteria requires that the leakage must be less than 20 percent." This statement by the Administrator is plain and simply false. Petitioner did provide explantations of the criteria that requires that leakage be minimized, preferably on the order of 20% or less as opposed to what there currently is—nearly 100%! This is detailed in petitioner's letter and comments to the Administrator of the FAA dated September 30, 1980, (see ex. G) Page 25, Xenex Comment to AIA 21.0 which, in pertinent part, states that "Uncontrolled aircraft leakage shall be maintained at less than 20%". ". . . to minimize axial flow of air and prevent migration of bacteria . . . ." Further, "The inflow should be a considerable margin above the leakage to maintain good pressure con-

trol and adequate ventilation." The now prevalent near 100% leakage leaves almost zero margin between inflow and leakage.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 3, PAR. 1

"Xenex proposes that contaminants be limited to 0.1 of the threshold limit values as established by the American Conference of Governmental Industrial Hygienists. Xenex proposes that cabin air be monitored for contamination caused by pathogens. Pathogens are any micro-organisms or viruses that can cause disease. No justification for this proposal is presented, nor is the action identified which is to be taken by an air carrier if such monitoring is instituted."

XENEX COMMENT—DENIAL OF PETITION—PAGE 3, PAR. 1

The Administrator has the audacity to suggest that "No justification for this proposal is presented, . . .". First of all, 0.1 of the threshold limit values established by the American Conference of Governmental Industrial Hygienists is a commonly accepted air quality standard applicable to the general population. That is ample justification.

Further, the petition states that, in many cases, 95% of the moisture in the air on board an aircraft is unsterilized sweat and breath from occupants on board. This simple fact by itself should be enough justification to a sensible mind to investigate what pathogens or micro-organisms may be present. We can only question what "justification" the Administrator is looking for—perhaps planeloads of people sick from influenza? Further, intermittent inspection of the air quality on board the aircraft is not unparalleled in other areas of our environment, for instance, our drinking water in metropolitan areas is monitored on a regular basis for contaminants and, in fact, much of our drinking water is treated to avoid harmful contamination. We consider this parallel to be ample justifiction for this proposal of interim or occasional monitoring of aircraft cabin air quality. As to the action to be taken by an air carrier: Obviously if contaminants are found in harmful concentrations corrective action should be taken by the air carrier as soon as possible.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 3, PAR. 2

"The petitioner proposes that the air on board shall be free of offensive odors. The issue of offensive odors involves subjective evaluation and is not an issue for which safety rulemaking is appropriate."

XENEX COMMENT—DENIAL OF PETITION—PAGE 3, PAR. 2

Contrary to the opinion of the Administrator, both health and safety rulemaking is appropriate as it concerns offensive odors inasmuch as offensive odors are oftentimes associated with harmful contaminants. Nevertheless, in the opinion of petitioner, the issue of offensive odors from a general standpoint, goes without saying. Who wants to sit captive for hours on end in an aircraft that has noxious or otherwise offensive odors? (While pilots have 100% fresh air).

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 3, PAR. 3, 4

"Xenex proposes that, at all times, the relative humidity in aircraft cabins be maintained between 30 to 50 percent. It is also proposed that water used to humidify the cabin be free of organic and chemical compounds in accordance with acceptable public health standards for potable water as defined by the American Conference of Governmental Industrial Hygienists. Xenex further proposes that the vapor in the air on board transport aircraft shall be composed of no more than 20 percent unsterilized perspiration and expiration originating from occupants on board."

"Xenex fails to show that there is a physiological need for such high levels of humidification during flight. Although human comfort may be affected by humidity, no evidence is presented by the petitioner to allow the conclusion that humidity, or lack of it, causes health problems in normally healthy people. Regarding the purity of water used for humidification, the petitioner has not shown that the quality of water used in humidifying systems has ever affected passenger or crew safety. The petitioner's proposal that water vapor not be more than 20 percent unsterilized perspiration and expiration is not supported. No evidence was found that such a requirement exists or is needed today for persons in any environment."

XENEX COMMENT—DENIAL OF PETITION—PAGE 3, PAR. 3, 4

The statements made by petitioner in Page 3, Par. 3 are nothing other than commonsense to any individual who cares to exercise same. That absence of humidity causes health problems to people is well known. This is documented by ASHRAE in their handbook Chapter 7 entitled "Health Facilities". I will take the liberty to quote a pertinent section from this. The paragraph is entitled "Air Conditioning In The Prevention And Treatment of Disease".

"Dry conditions constitute a hazard to the ill and debilitated by contributing to secondary infection. . . . Humidities in the range of 50 to 55% have been shown to be more lethal to certain bacteria. . . ."

In addition, the following information, which has been presented to both the ASHRAE and the American Association for the Advancement of Science clearly shows that the lack of humidity "causes health problems in normally healthy people" in contrast to the opinion of the Administrator. The title of the paper is "The Effect of Indoor Relative Humidity On Absenteeism and Colds in Schools". The abstract reads as follows: "A linear correlation between indoor relative humidity and percent absenteeism was obtained in twelve Saskatoon public schools showing a 20% reduction in all absenteeism as average relative humidity during school hours was increased from 22 to 35%. Results were supported by data obtained in 6 Halifax, Nova Scotia public schools, a Swiss kindergarden, and in American army barracks. Sufficient evidence leads to the conclusion that there is a significant reduction in respiratory disease with an increase in relative humidity of occupied spaces." The paper is writen by Prof. G. H. Green, with the Department of Mechanical Engineering, University of Saskatchewan, Saskatoon, Saskatchewan, Canada and it was printed in the ASHRAE Journal, January 1975. (See ex. H.)

Moreover, it is common practice to humidify homes when the air taken in from outside is very dry. This practice has gone on for decades, if not centuries.

Concerning the purity and quality of water used for humidification, the present practice of reducing fresh air ventilation so much that the humidity levels rise up to in excess of 50%, virtually all of which is sweat and breath from the occupants on board, clearly indicate health hazard to the passengers especially if there are diseased individuals contributing to the moisture on board. It is believed that this circumstance causes health problems especially in the confined environment of an aircraft. That the humidity levels on board aircraft can, on occasion, exceed 50% relative humidity, has generously been submitted by the Air Transport Association in comments to our petition for rulemaking where they point out that the relative humidity levels can get as high as 59%. Again, virtually all of this humidity is the unsterilized sweat and breath from the occupants on board. The petitioner is proposing in the petition that the water which in this case is used for humidification, is (a) contaminated and (b) potentially hazardous for the people using the transport system.

In the cases where a special system is incorporated into the aircraft for the purpose of increasing the relative humidity on board, it should go without saying that the water used for these purposes should be free of contaminants. For the Administrator to belabor this issue seems to be a waste of time and money especially, "when fiscal prudence is clearly called for in every activity we (FAA) undertake".

The FAA Administrator goes on to say "No evidence was found that such a requirement exists or is needed today for persons in any environment." The Administrator is referring to the fact that the petition called for unsterilized perspiration and expiration to be minimized on board aircraft as a percentage of the total moisture content in the air on board the aircraft. It is easy to understand why "no evidence was found" that such a requirement exists or is needed today for persons in any environment. The reason for this is: There is virtually no other environment than on an aircraft where such a circumstance occurs. At least in the industrialized world, it is a de facto circumstance, based on existing ventilation and health regulations. It is virtually impossible to encounter circumstances where a large portion of the moisture in the air we breathe is all other people's sweat and breath.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 3, PAR. 5

"The Federal Aviation Administration published the Xenex Corporation petition for rulemaking, verbatim, for public comment, in the Federal Register (45 FR 41962) on June 23, 1980. All communications received on or before August 22, 1980, were considered by the Administrator before this action was taken. The FAA received comments from 29 individuals, organizations, and companies in response to the petition. The majority of these supported either the petition or the intent of the petition without taking a position on the particular levels for humidity, contaminants, or

fresh air circulation rates. Two commenters cite illnesses, flu and chicken pox, contracted after an airline flight, which they attributed to poor air quality on the airplanes. Several comments were made that the fresh air ventilation standards for aircraft are not equal to those of other public or non-aviation environments. None of these comments were substantiated by information or data."

XENEX COMMENT—DENIAL OF PETITION—PAGE 3, PAR. 5

The Administrator says, among other things, that "All communications received on or before August 22, 1980 were considered by the Administrator before this action was taken." That is false. Petitioner personally delivered comments to the FAA prior to the legal deadline 5:00 PM August 22, 1980. Comments were hand delivered by the petitioner 10 minutes to 5:00 PM and we have a signed statement (see ex. N) from the Docket Clerk to this effect. These statements were not considered by the Administrator. Contrary to the Administrator's statement "none of these statements were substantiated by information or data" were in fact, substantiated sufficiently to warrant investigation and correction of the apparent problems.

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 3, PAR. 6

"There were comments from five organizations and companies opposed to the petition. The Aerospace Industries Association, (AIA) contends that implementing the proposal would cost the airlines ($633 million per year for the Boeing 727 aircraft fleet and $1.319 billion per year for the Boeing 747 aircraft fleet. This contention was supported by a detailed cost analysis. In addition, data were submitted which show that the ventilation rates and number of outdoor air changes per hour for seven different air carrier aircraft exceeds the most stringent recommendations for public gathering places, especially night clubs."

XENEX COMMENT—DENIAL OF PETITION—PAGE 3, PAR. 6

The cost figures cited by the Administrator appears to be nothing but a carte blanche acceptance of the AIA's statement opposing the petition. In subsequent comments the petitioner has pointed out that the cost analysis was, even by a cursory glance, erroneous. The Administrator does not present any cost analysis of the FAA which would support the denial of the petition as it concerns the "ventilation rates and number of outdoor air changes per hour for 7 different air carrier aircraft", ". . . and that they exceed the most stringent recommendations for public gathering places, specifically night clubs." It was pointed out to the Administrator that this information is erroneous and is not a fact of real life. The chart in exhibit D clearly shows that the ventilation rates, the outdoor air requirements, in other words the fresh air ventilation rates, for aircraft cabins is, in practice, 1/5th to 1/10th of what the minimum standards are for acceptable indoor air quality for various non-aviation environments where the occupancy density in those environments is only half of what it is on an aircraft. For instance, the minimum outdoor air requirements for a cocktail lounge, where smoking is permitted, is 50 cu. ft. per person per minute (cfmp) based on 100 people per 1,000 feet of floor area. The occupancy density on board aircraft is on the order of 200 persons per 1,000 feet of floor area. And the current practices of fresh air ventilation rates on board aircraft are, in many cases, less than 7 cfmp. In some cases, we measured [3] below 4 cfmp. For the Administrator to use this totally false statement as support to deny the petition is quite frankly outrageous. (See exs. D and F.)

ADMINISTRATOR'S STATEMENT—DENIAL OF PETITION—PAGE 4, PAR. 2, 3

"The petitioner submitted a general rebuttal to the cost estimate from the AIA. However, while recognizing that the proposals would be costly, the petitioner did not offer any counter cost estimates nor did it present data to show that any retrofit of additional equipment is justified in the interest of aviation safety. In this connection, it may be noted that FAA regulations do not preclude installation of additional air conditioning, filtering, and humidifying equipment that meets airworthiness standards should an airline elect to do so in the interest of increasing passenger comfort.

"In consideration of the foregoing, I find that the petition does not justify instituting the rulemaking procedures requested by the petitioner. Therefore, in accordance

[3] Fresh air ventilation can be accurately determined by means of measuring the levels of carbon dioxide and/or relative humidity on board the aircraft.

with rulemaking procedures of Part 11 of the Federal Aviation Regulations, the petition of the Xenex Corporation to amend §§ 25.831 and 121.219 of the Federal Aviation Regulations is hereby denied."

XENEX COMMENT—DENIAL OF PETITION—PAGE 4, PAR. 2, 3

Contrary to this statement, ample data was available to the Administrator at the time of his decision justifying change and improvements in the air quality standards on board aircraft, as were cost estimates for improving the air quality. The Acting Administrator mentions "retrofit" although ultimately this may be the case, the petition also points out that the existing equipment on board the aircraft intended to protect the health and safety of the occupants thereof, is not even being operated. The equipment is turned off or removed (see ex. T) to save fuel. The Administrator failed to address this issue at all.

As it concerns the questions of toxic fume protection, we wrote the Administrator about this matter and we were assured by the FAA representative who responded that the matter of toxic fume protection for passengers would be addressed (see ex. B). As is apparent in the denial of the petition, there is not even a mention of it. This, in spite of more than 3,000 aircraft smoke and fire occurrences in our country over the last 5 years, and not a single instruction to passengers of what to do during such in flight emergencies. The only reason the writer can find for the conspicuous silence by the Administrator concerning these serious safety issues is (a) ignore it and hope it will disappear or (b) When someone is caught with a smoking gun, there just isn't anything to say!

The serious issues are not going to disappear. The silence is not going to make things better nor will false statements.

Conclusively, as it concerns the petition denial, I believe it should be clear to anyone that the denial is unfair, unacceptable and unjustified. It is clearly an act in violation of the duties of the Administrator under the Federal Aviation Act of 1958. The petition denial is not in the best interest of the nation, its aviation industry, nor its air traveling citizens.

Question 2. I understand, after studying the Ashrae Ventilation Standards, that there is a difference in the requirements when there is smoking allowed as opposed to when smoking is prohibited? Would it be appropriate to prohibit smoking on board aircraft in order to improve the air quality and if not, what are the possible solutions to this dilemma of the "rigths" of smokers and non-smokers.

Answer. Yes, it is true that the ASHRAE Ventilation Standards, which incidentally only addres the non-aviation environment, reflect a difference in the fresh air ventilation requirements when smoking (see exs. F, K, L, P, Q) is permitted as opposed to when it is prohibited. One should bear in mind that individual exposure to the environment that these standards impose is essentially voluntary from the standpoint that if the environment is found to be undesirable or unsatisfactory, an individual can, at will, leave such premises. The standards also take into account the de facto circumstances encountered in the non-aviation environment such as the air pressure and consequently, oxygen content of the air. Further the ASHRAE Standards 62-1981 "Ventilation for Acceptable Indoor Air Quality" reflect minimum requirements of outdoor air (see Exhibit F). Not always, but in many cases, our daily environment reflects fresh air ventilation rates that are far above the minimum health safety standards of ASHRAE. Add to the foregoing the fact that the per person available volume for dilution in the occupied spaces in the non-aviation environment is far greater than the circumstances encountered on board an aircraft. For instance, in many offices, 2,000 cubic feet per person is ot uncommon whereas the per person available volume on an aircraft is, in many cases, only on the order of 35 to 75 cubic feet.

Philsophically, therefore, it would appear that the rights of non-smokers on board an aircraft would supercede those of the smokers based on the premise that clean fresh air, as well as clean fresh water, are rights that are as basic, perhaps even more basic, than that of, for instance, freedom of speech.

What complicates the matter is that tobacco smoke is merely one visible and odorous contaminant of a multitude that can be encountered on board an aircraft. Certainly if smoking were prohibited on board aircraft, the irritation from this contaminant to the non-smoker would be eliminated. This approach, however, would not solve the overall problems that S. 1770 addresses. Nor, and this is a well known fact, would it serve to improve safety on board aircraft, inasmuch as addicted smokers would surreptitiously proceed to smoke in restrooms or elsewhere, especially on long flights. This circumstance would seriously compromise safety. Serious accidents with

substantial loss of life have already occurred where the smoking was not or should not have been permitted.

The railroad industry solved "the smoking problem" countless decades ago by providing separate compartments with separate ventilation for smokers and non-smokers and offering space on a first come first served basis. By so doing, the rights of smokers as well as non-smokers were apparently adequately protected. So, obviously this dilemma has a simple solution. The airlines need merely section off the aircraft into two compartments, one that permits smoking and one that does not and, of course, the air from the smoking compartment should not be recirculated to the non-smoking compartment as it is now.

Perhaps the most practical and most appropriate solution to the problem is adequate fresh air ventilation which would essentially eliminate the need for a partition. Proper fresh air ventilation rates would accomplish a transverse flow to the axial fuselage extension (i.e. flow from ceiling to floor) thus preventing migration of smoke in the axial direction (lengthwise) of the fuselage and, of course, recirculation of air should not be permitted unless it could be demonstrated that through proper filtration means, the contaminants of tobacco smoke were eliminated. The current state of the art of filtration equipment for aviation use is not sufficiently advanced to economically, effectively and in a practical manner cope with tobacco smoke contaminants.

On a related note, we believe it appropriate to caution anybody, who is studying the aviation smoking non-smoking issue, that it in itself is not the singular issue. Tobacco smoke merely happens to be one visible irritant and contaminant produced by the occupants on board. If, for instance, we could smell or see all the micro-organisms and other substances that are produced on board the aircraft, we would not even consider, for an instant, the possibility of reduced fresh air ventilation rates for the non-smoking section of an aircraft. Although contamination from tobacco smoke is, in one sense, a controllable pollutant, pathogenic micro-organisms and carbon dioxide are not controllable from the source. These contaminants are of a constant output. In other words, one can stop smoking and reduce the carbon monoxide on board. However, one cannot stop breathing to reduce the pathogens or carbon dioxide. Therefore, the recognized solution to the problem is increased fresh air ventilation and thereby removal of the contaminants from the occupied space. Appropriate fresh air ventilation will protect the health and safety of both smokers and non-smokers as is evident from comments by Dr. Clayton, ASHRAE, Dr. Elliot Dick (testimony presented at May 20 hearing), Dr. Leslie Tam, Dr. Stuart Rusnak, and others. Dr. Stuart Rusnak's comments reveal some particularly serious circumstances. His comments deserve serious attention and immediate action (see exs. E, F, J, and Q).

One very interesting matter concerning the rights of smokers and non-smokers vis-a-vis the popularity of the Senate Bill is what the southern Senators representing the tobacco lobby would benefit immensely by supporting this Bill, as would, of course, the members of the Tobacco Institute. The reason for this is that currently much of the blame for indoor air pollution is wrongfully attributed to smokers when, in fact, the blame should be placed on the parties responsible (in this case, the FAA and aircrift operators) for providing adequate fresh air ventilation for the purposes of removing smoke contamination and thereby meeting minimum health and safety standards.

For the Tobacco Insitute, its members and the southern Senators to support this bill would immensely enhance their public relations image and the consequences would, of course serve to improve the rights of smokers as well as non-smokers.

Question 3. You mention in your testimony that the cost of improving fresh air ventilation is on the order of 50¢ on a transatlantic ticket that costs approximately $600.00. The FAA cites cost figures exceeding a billion dollars for improving fresh air ventilation. I understand from other testimony previously provided that improving the fresh air ventilation rates in the passenger cabin to, for instance, 50 cubic feet per minute per person (cfmp) may not even be possible with today's aircraft engine technology since the air for pressurizing the cabin is derived from the turbine compressors. There seems to be an obvious conflict between your position and that of the FAA. Please explain.

Answer. Our explanations to the conflict between our statements in the petition and that of the FAA not only addresses the technology and economic issues but the philosophic ones as well. First of all, as it concerns the economics and the current state of the art, by this we mean the equipment currently installed on existing aircraft, our records show that a reduction of fresh air ventilation rates from an approximate maximum design capacity of 15 to 20 cfmp of fresh air to 5 to 7 cfmp of fresh air translates to a fuel savings for the airlines in the equivalent amount of

approximately 50 U.S. cents on a transatlantic ticket (which currently costs approximately $600.00 in the economy section of the aircraft).

It is not clear to us whether the billion dollar figures cited by the FAA for improving fresh air ventilation takes as a starting point the 5–7 cfmp of fresh air or the 15–20 cfmp of fresh air. Nevertheless, the FAA has been advised that cost estimates that we believe they refer to are erroneous in several ways. For example, the cost of fuel had been exaggerated, the latest state of the art technology had not been investigated or assessed in the context of their cost extimates. Nevertheless, from a judicial, moral and philosophical standpoint, the cost involved for maintaining appropriate and established health standards is not the issue, as it concerns the industry.

The cost for providing satisfactory and healthy and safe environment on board aircraft is a cost borne by the traveling public, not the airlines nor the airframe manufacturers. This is the case in the non-aviation environment. Any business enterprise survives on the basis of at least meeting its costs and in conjunction therewith also providing a percentage of profit. Providing minimum safe and healthy quantities of fresh air ventilation on board an aircraft should, and always will be, a fundamental cost of doing business. For the FAA to argue otherwise, as it appears they do, is not only hurting the traveling public but the aviation industry as well. It would save billions of dollars to construct aircraft with a lesser safety factor than that now employed—weaker materials, cheaper alloys, etc. The FAA seemingly denigrates the basic safety measure of providing enough fresh air to prevent passenger asphyxiation to something less than the structural integrity of the aircraft. It is not, we submit, enough to get the passengers to their destinations; it is equally important to get them there in the same condition as when they embarked.

As with all industries, there are ups and downs. It is unfortunate that the aviation industry in this country has currently encountered economic difficulties. However, in the interest of not only preserving the industry but also protecting the workers in the industry and the traveling public, I think it would be quite clear that if, for instance, an airline does not have the economic wherewithall to provide for basic health and safety criteria, then they have no reason to be in business, i.e. they do not serve to enhance the reputation of the industry nor do they serve the interest of their employees or the public.

By way of example, one does not permit an aircraft to take off with one or two tires flat, one or more engines malfunctioning, etc. These are basic safety criteria. Likewise, it is with the provision of minimum quantities of fresh air for health and safety purposes.

As it concerns the provision of, for example, 50 cfmp, or 150 cfmp of fresh air, this is not an issue which must await the development of future exotic technology. Not at all. It is a simple economic issue. As with any solution to a problem there are some that are better than others and some that are worse. The capacity for transporting people and cargo in aircraft has grown enormously over the last 3 or 4 decades. The direction and focus of the industry has been to maximize the capacity, with the least economic penalty, to transport crews and people from one point to another. A review of the developments over the last few decades will reveal that little or no attention has been given to allocating even a small portion of the improved capabilities of transport aircraft towards passenger health and safety, other than from the standpoint of having an equal number of live souls disembark from the aircraft at it destination as embarked at the point of origin.

The matter of providing increased fresh air ventilation merely requires the installation of an additional compressor for this purpose, if the airbleed from the turbines would prove excessive. Obviously there is a simple solution to the problem. Installing an additional compressor, for which incidentally there is ample space on board any aircraft flying today, is just one solution of many. It may not be the best economic solution but it would certainly remedy the problem. For instance, a fully loaded 747 scheduled for a five hour flight would weigh on the order of 700,000 pounds. Even if one chose to allocate a few thousand pounds for the purpose of improved health and safety by installing additional equipment, we think it would prove to be a trivial investment in contrast to the substantial health and safety benefits. The costs for so doing are simple to perceive. Every 3,500 lbs. of equipment added to, for instance, a 747, based on full occupancy, would add approximately $1.00 to a 5 hour ticket—Hawaii to California!! (U.S. $300–400 per 3,500 lbs.). This is based on retail cargo rates!

The scientific way of calculating the costs is based on the lbs. of fuel per hour used per lbs. of added weight for a 3,000 hr/yr airplane. The accepted values are .050 for 747's; .0266 for L–1011's; .0395 for A300's; .0253 for DC10's and .056 for 707's. Simple calculations then reveal the cost for 3,500 lbs. of added ventilation equip-

ment is approximately 35 cents per seat per 5 hour trip! The FAA is implying the public and airline employees cannot afford to spend this pittance for their health and safety. This is absurd—we all expect to pay it, in fact, most people believe it is presently included in the price of their ticket.

Xenex Corporation has proposed various ways of improving the quantity and quality of fresh air ventilation on board aircraft and doing so in a more economic way than the prior described procedure of installing an additional compressor. The methods proposed by Xenex would, among other things, encompass the return of cabin air to the compressor which the cabin air is usually bled from. This method would reduce the fuel penalty which is commonly associated with fresh air ventilation. The return of cabin air to the turbin compressor will assist in cooling the incoming air and can also be used for humidification of the aircraft cabin. Moisture is extracted from the outgoing air, purified and then sterilized when returned to the incoming air. Needless to say, the foregoing is merely a simple explanation of one of the several Xenex aircraft pressurization and ventilation methods and humidification.

At this juncture, although circumstances vary with aircraft types and operations it appears eminently reasonable to say that appropriate fresh air ventilation on board aircraft can be accomplished for less than $1.00 on the average ticket. In some cases it may be as little as 5¢, other cases 50¢. Regardless, it is possible to do it and it is possible to do it today. That is if there is a will to recognize the serious problems and correct them. We believe the cost on an average ticket will be on the order of 10-15¢.

Question 4. I am disturbed to learn that while the pilots are provided toxic fume protection in the event of smoke or fire on board, there is no such requirement for the flight attendants nor is there any for the passengers. Would you please indicate your understanding of the rationale for this difference in requirements. And also explain how these serious deficiencies can be corrected and what it would cost to do so?

Answer. We are also disturbed about the fact that while equipment and instructions are provided for the pilots of what to do and how to protect themselves from lethal toxic fumes, no such provisions exist for the passengers or the cabin crew. In fact, the writer frequently travels by air and is cognizant of circumstances and details of toxic fume hazards, in the absence of protective breathing equipment or even simple instructions for that matter. I have often reflected on the now infamous manual page from the pilots operating manual of one of our popular current aircraft.

It seems to be a circumstance which is virtually devoid of morality or commonsense. The pilots manual (see ex. U) instructs the pilots to don their protective breathing equipment, which incidentally in most cases they must be able to don in a few seconds. While the pilots are then protected one of their instructions is "It is not recommended that the passenger oxygen masks be deployed when excessive smoke is in the passenger cabin. The passenger oxygen masks are not smoke masks and were not designed, tested or certified to serve this purpose. These masks supply a breathing mixture which consists primarily of cabin air, admitted through an inlet valve in each mask, and a relatively small amount of pure oxygen from the cabin oxygen distribution manifold. Thus, in a smoke-filled cabin, any noxious fumes would be inspired directly in the passenger oxygen masks, and the small amount of manifold oxygen present would provide no significant displacement of dilution of toxic agents." The passengers' safety is in the hands of the captain and his subordinate officers. Yet, as it stands now the record clearly shows that in the face of known hazards, in some cases, nearly instantly lethal toxic fumes, the captain and his officers are in essence instructed to ignore this fact and to do nothing about it. The whole matter is so preposterous it defies any reasonable explanation.

Attempting to provide an explanation, embarrassing as it may be, I believe that economic considerations have been the underlying factor for why there presently is no toxic fume protective breathing equipment for passengers and crew. Also, it is very noteworthy to consider that the traveling public, airline personnel, as well as many FAA employees presently are under the false belief that the oxygen masks on board aircraft are useful for smoke protection. Therefore, if the public already believes they are adequately protected why provide any protection or, as they say "why rock the boat" with its legal, moral and economic implications. In my opinion, had the FAA addressed the issue, even from the standpoint of providing some instructions of what to do in smoke and fire emergencies, the technology would then have rapidly evolved so as to reduce the economic impact, borne by the public, not by industry. It is now a recognized fact that meaningful smoke and toxic fume protection should have a duration of between half to one hour and the equipment

should be portable. The prior state of the art also had a weight penalty associated with the duration of toxic fume protection on the order of 20 to 30 pounds per person for a little more than half an hours protection. Weight on an aircraft, as we know, translates into extra cost in fuel burned to carry this weight. With current fuel prices and energy efficiency concerns, the cost per seat/per year could mean several thousand dollars savings resulting from the absence of toxic fume protection breathing equipment for passengers and cabin crew, coupled with the fact that the old state of the art required substantial amounts of compressed air or oxygen on board the aircraft to satisfy the toxic fume protective breathing needs. This in itself would pose a very severe hazard. In the event of a rupture of a pressure vessel containing this compressed gas, which is commonly stored at 1500–1800 psi, the rupture of such a container could seriously endanger the safety of the flight or, for that matter, be lethal to the occupants on board.

In any other environment protective equipment is either provided or available de facto. In other words, in a hotel fire, you have a fire staircase and there are windows to open, one can call the fire department, there are ladders to escape by, rooftop helicopter rescue, in short a multitude of protective alternatives. In an aircraft cabin, considering the enormous toxicity of some of the products of combustion from aircraft fires, there is nothing. One is simply a captive with no protection, not even instructions! These are the circumstances the FAA considers satisfactory, in the face of more than 3,000 fire, smoke and fume occurrences on board U.S. aircraft (see ex. C) and a recent rash of asphyxiation due to toxic fumes on board American made aircraft which are believed to total more than 600 fatalities in little more than a years time.

As to the solution to the problem of toxic fume protection and the consequent cost, Xenex Corporation has offered industry some viable solutions. Very simple and very inexpensive. Based on their operation, one airline has estimated the sustained cost of making available this toxic fume protective breathng equipment at approximately 1¾ cents per ticketed passenger. In other words, next to nothing and bear in mind the passengers pay for it. The systems and methods that Xenex Corporation has proposed can be explained in simple terms as follows: The air which is used to pressurize the aircraft comes in as clean fresh air from the outside of the aircraft. A small hood is connected to the pneumatic system and available for each passenger to don. The hood fits hermetically for grownups and children as well. The hood functions as a reservoir for fresh air. Depending on the respiration rate, a 20 liter capacity above and beyond the space occupied by the cranium and the neck, permits up to 8 minutes of portable air supply when disconnected from the supply source. This has been confirmed and tested by the Civil Aero Medical Institute (see ex. Z). While connected to the supply source a continuous amuont of fresh air is provided to the user (well in excess of the 90 second evacuation requirement). The additional weight penalty associated with installation of this equipment is on the order of 1 pound per seat, and in many cases, less. At 1 pound per seat the cost for a passenger on a 5 hour trip is between 2½ and 4½ U.S. cents!

The systems also incorporate various gas detection devices, in order to determine when the systems need to be used as well as to assure the integrity of the system itself.

Near future development of the systems will also facilitate the use of this single device as a combination unit for protection against smoke and toxic fumes as well as providing supplementary oxygen in the event of sudden decompression. It has been suggested that this method, as it concerns the provision of supplementary oxygen, would constitute an improvement over the existing state of the art, in addition to the benefits of toxic fume protection (which are now non-existent).

In addition to the foregoing, it is expected that a personal protection device, which can be carried by an individual passenger, and be utilized on board aircraft equipped with individual fresh air outlets, will be available to the public by end of this year or early 1983.

Question 5. The need for studies is obvious. What do you believe would be on the study list? Please indicate relative importance of items that should be studied.

Answer. We agree that the need for studies is obvious, conspicuously so. Ultimately the "study list" would have to reflect the composite views and concerns of several different parties. Some of these views, concerns and suggestions for studies are, of course, already apparent from the testimony provided by Dr. Elliot Dick, Dr. Charles Billings, as well as Mathew H. Finucane, Dir., Aviation Consumer Action Project, Carmen M. Azzopardi, Dir., Health & Safety, Independent Union of Flight Attendants and Susan Miller, Acting Health Coordinator, Association of Flight Attendants, and comments by Dr. A. J. Clayton, MB, ChB, DPH, FFCM, FRCP(C), Dir. General, Laboratory Centre for Disease Control, Dept. of National Health & Wel-

fare, Ottawa, Ont., Dr. Leslie Tam, PhD., Dr. Stuart Rusnak, MD, and Xenex Corporation exhibits, publication by Prof. James Repace and Prof. A. H. Lowrey, a publication by Prof. George Green, Jeffrey Hohn, Manager, ASHRAE Standards, and other Xenex exhibits concerning EPA standards, McFarland concerning human factors in air transportation, airborne infection by Riley and O'Grady etc. etc. (see exs. A, E, H, J, K, P-S.)

From the standpoint of "normal operations" we believe it would be prudent to test the air quality on large, medium and small air transport aircraft when fresh air ventilation is at a low of 3-5 cfmp on fully loaded aircraft as well as when it is at maximum capacity on older aircraft that do not have recirculation capabilities. In each instance, we believe it would be appropriate to simultaneously monitor the cockpit air quality at variable fresh air ventilation rates. These studies should include, but not necessarily be limited to, common micro-organisms, gas and particulate contaminants that are recognized and regulated in the non-aviation environment. Following is a list of some of these contaminants: (See ex. F.)

Carbon Monoxide, Lead, Nitrogen Dioxide, Oxidants (Ozone) Particulates, Sulfur Dioxide, Acetone, Acrolein, Ammonia, Beryllium, Cadmium, Calcium Oxide (Lime), Carbon Disulfide, Chlorine, Chromium, Cresol, Dischloroethane, Ethly Acetate, Formaldehyde, Hydrochloric Acid, Hydrogen sulfide, Mercaptans, Mercury, Methyl Alcohol, Methylene Chloride, Nickel, Nitrogen Monoxide, Phenol, Sulfates, Sulfuric Acid, Trichlorethylene, Vandium and Zinc, and Carbon Dioxide.

It would be most appropriate that various not-so-common organic or inorganic contaminants and their occurrence on board aircraft also be examined, such as the microorganisms causing tuberculosis, Legionnaire's disease, Laza fever. An investigation of the existing literature should be made of already documented material from the Center for Disease Control (CDC) as well as the National Aeronautics and Space Administration (NASA) and other private, quasi governmental U.S. as well as foreign sources including FAA and industry sources such as AIA and ATA. The study list should take into account known contaminants at various altitudes that may vary by geographic location. Data for these purposes should be available in part from the Global Air Sampling Program (GASP).

The issues of radiation levels and effects at high altitudes should also be considered from galactic sources as well as radiation levels and effects in connection with solar flare activity. Although galactic radiation is believed to be relatively constant, the radiation from solar flare activity is not. The solar flare radiation varies through an 11 year cycle with sudden large bursts in the peak period of the cycle. This is well known. I believe NASA as well as other foreign agencies can contribute worthwhile information concerning this. Neutron radiation is of particular interest due to its severe biolgical effects. Although the FAA has sponsored some studies in this area,[1] I consider them incomplete. In this regard it would also be most appropriate to examine the air distributed in the cabins for ionized matter.

Due to the lack of credibility of the FAA which sponsored the prior studies, it is appropriate that these issues be re-examined thoroughly and independently.

Summarily, as it concerns normal aircraft operations, we believe there may be a substantial amount of data already available so the study list should, therefore, have as its Number One priority the retrieval of such data and, of course, later the assessment of credibility of this data as it concerns the matters of S. 1770. E.g. we would not deem it appropriate to include a study such as referenced by the FAA "Human response to 78 hour exposure to dry air" without the caveat that the study is not applicable to the "real world" as it now exists on board airliners. Studies should be geared to duplicate the aircraft environment in terms of pressure, contaminants, occupancy densities (max.) etc. Secondly, the on-board studies for microorganisms and gaseous and particulate contaminants should be conducted at the earliest convenience and in such a manner as to reduce or eliminate the chances of biased results. Subject to the results, if it is warranted, thorough studies of the on board environment should include source assessments whether contaminants are generated from materials of construction in the aircraft structure itself, from clothing, cargo, luggage, or, for instance, as it concerns ozone, the generation of ozone on board the aircraft by virtue of static electricity.

At this point, we believe it is clear that contrary to the FAA's gratuitous statements and attitudes there are problems with the on-board environment in aircraft.

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[1] Britain and France have regulations requiring radiation monitoring and warning equipment on certain aircraft. It is interesting to note and certainly worthy of verification that we believe the FAA has sponsored many studies concerning radiation effects in air commerce whereas little or nothing of any credibility has been accomplished as it concerns the issues of this Senate Bill (S. 1770). If this proves to be true, one must certainly ask why?

The studies should address what the actual requirements are to correct these matters to safe and acceptable limits, from a cost, as well as time, standpoint.

It should not be forgotten that the studies and assessment of data derived from the studies should carefully take into account the uniqueness of the aircraft environment, such as low pressure and the mixture of different flora of micro-organisms from all corners of the world to which some persons have immunity and others not. The broad spectrum of travelers and their health conditions must be a paramount consideration in the course of studies and recommendations for standards or regulations.

Currently there is a complete absence of effective quarantine. The potential spread of diseases is, therefore, increased. This circumstance has only occurred in the last few decades with the advent of air travel and is rather unprecedented in modern times. It deserves study.

As it concerns the air quality standards issue during abnormal operations, I see a lesser need for studies in this area above and beyond what is already being advanced by the industry itself. I believe any sensible person will realize the fact that if we have not been able to fireproof the structures we build on earth after several thousand years, the likelihood of us doing it in the case of an aircraft where all kinds of combustible cargo, luggage, etc. are being carried, is essentially nil. I believe that the issues of safer fuels and safer materials and their implementation in aviation should be considered in regard to S. 1770 from a general standpoint, however, the details thereof I believe would be more appropriately addressed by a separate hearing.

That toxic contaminants can be encountered in flight and for that matter in a post crash environment are painfully well known. Whether contaminants eminate from cargo or luggage or combustion from interior materials is essentially academic. The fact is well known that many, if not most, products of combustion in sufficient quantity are lethal. I believe, therefore, that the studies as it concerns abnormal operations should first and foremost, address the issue of how soon can protective breathing equipment be implemented for the crew and passengers utilizing the air transport system.

In connection with the preceding paragraph, it is noteworthy to consider that the "SAFER Committee", (see ex. V) which comprised ". . . approximately 150 of the world's top experts in fire research, operations, accident investigation, materials developments, systems design and aircraft fire and occupant safety . . ." recommended "immediate action" to "reevaluate use of personal protection devices" against toxic fumes and flames. The FAA has studied the matter since the mid 1960's (see exs. R, V, W) and even issued notice of proposed rulemakings to require smoke-hoods. This was done more than a decade ago. Smoke generation tests have been discussed for more than a decade (see ex, M). In light of the foregoing one can only question how long the traveling public and airline crews are supposed to contend with seemingly endless rhetoric as a substitute for appropriate action by the FAA. Not to be forgotten, is the issue of "fiscal prudence" which the FAA so charitably throws around in its statements opposing Senate Bill S. 1770. We believe it is fiscally prudent to study and correct the problems since the problems may directly and indirectly cost the public and industry billions of dollars.

I should like to point out that the transparently naive approach suggested by Mr. Baird in his testimony that there is no need for toxic fume protective breathing equipment because the FAA is directing its efforts to fireproofing the aircraft is a slap in the face to any person blessed with even a small amount of commonsense. The FAA's suggestion for study and improvements of "fire blocking layers for seats" that "should break the fire chain" and "to study means of improving the removal of smoke and toxic fumes resulting from inflight fires" at the expense or instead of toxic fume protection for the occupants is preposterous. Given the snail-like pace and the historically cavalier attitude of the agency, the fruits of labor that Mr. Baird is referring to could perhaps appear to the common traveler in 20 to 30 years. Obviously, the area he refers to should be pursued. In fact, one would take it for granted that FAA is doing so under its charter of the Federal Aviation Act of 1958. However, I would vehemently object to the argument that it be done in place of providing toxic fume protection for passengers and crew against known lethal hazards.

So, to summarize my answer of what the study list should be, I must point out that my answer is based on the fact that the FAA has not established any standards to begin with. Therefore, studies for known contaminants should be established and the studies should, of course, address what is, in fact, occuring on board aircraft in flight.

The most important items to be studied are the acceptable levels from a health and safety standpoint for the general population for carbon monoxide, carbon diox-

ide, the exposure to sudden changes in air pressure (i.e. from sea level to 8,000–10,000 feet) and micro-organisms.

The study list for abnormal operations should, of course, include a review of the efforts being made to remove smoke and toxic fumes from the aircraft cabin and the improvements of cabin materials. I stress that there is no need to study whether or not toxic fume protective breathing equipment is required. The FAA has known and studied that for decades. The FAA has also been advised by the prestigious SAFER Committee to take immediate action on the issue of fire and toxic fume protective breathing equipment for passengers. The FAA was advised of this two years ago (1980).

We would recommend that a panel of independent experts and industry representatives establish the study items and their priorities along with estimated costs and timescales for completion. Such a panel should be able to provide a sound recommendation on 30–60 days notice.

Included as top priority in the items for a study list should be the establishment of a meaningful medical data base and imperatively the examination of the effects of air travel on the millions of passengers who have ischemic heart disease. Current information on this subject matter indicates, as I stated in the May 20, 1982 hearing, that 6–7 out of every 100 air travelers with this medical affliction die within 3–4 days of air travel (!) The cause appears to be the environment on board the aircraft. However, due to the delayed reaction, air travel may incorrectly not be associated with the fatalities. Available information from the American Medical Association and my Exhibit 13 from the May 20, 1982 hearing indicates potentially staggering and serious problems, with lethal consequences, are confronting unsuspecting air travelers.

Question 6. In your opinion, what should the maximum contamination standards on board aircraft be for carbon monoxide, carbon dioxide, ozone, and micro-organisms? What are the known effects when one is exposed to excessive levels of, for instance, carbon dioxide? Please supply the basis for your statements.

Answer. First of all, as it concerns contamination on board aircraft one must consider the original source of the contamination. There are contamination sources originating from outside the aircraft (i.e. O_3, CO) and there are those that are produced on board (i.e. CO, CO_2 etc.). Maintaining contaminants at acceptable levels is accomplished in two basic ways; through appropriate fresh air ventilation or appropriate fresh air ventilation in conjunction with filtration equipment which is capable of absorbing and eliminating the undesirable contaminants from the air (in the cabin). Maximum contamination standards for well known and common contaminants, even rare ones for that matter, are established in most western nations. The standards that should apply especially for the passenger compartment of an aircraft should take into account that passengers are of a broad spectrum, from the elderly and infirm to healthy young adults to frail infants. However, applying the EPA standards or similar standards developed for the non-aviation environment may not be appropriate due to the unique and uncommon circumstances that exist on an aircraft, i.e. the reduced pressure and reduced oxygen levels coupled with low humidity and low quality of the humidity. In addition, the aircraft environment is unique in respect that people from all corners of the earth can be found in one aircraft cabin, all with different tolerances to certain contaminants.

Although human tolerance to certain contaminants is rather uniform, regardless of where people come from, the human tolerance may vary greatly to other contaminants such as pathogenic micro-organisms. This historically has been demonstrated over and over again where, in some cases, entire localized populations have died due to unfamiliar disease brought to them (i.e. by the early explorers). In principle, this circumstance is not changed today. Therefore, when large numbers of people are brought together in a highly congested aircraft cabin, it is obviously important, from a health and safety standpoint, to contain or restrain contamination by micro-organisms to an absolute minimum especially pathogenic ones.

From the foregoing considerations it would, therefore, appear that EPA standards or, for that matter, standards established in other countries, by respective responsible agencies, may not, in fact, be sufficient to adequately address the health and safety hazards confronting air travelers. On the other hand, it can be argued that prior testimony that has been provided shows that an air exchange approximately every minute is the recommended level to maintain pilots in a healthy condition free from respiratory and related ailments.

So, from that standpoint one can surmise that that level of air exchange or per person fresh air ventilation rate prevailing in the cockpit should be adequate to solve any on board generated contamination problems (see ex D). However, we don't believe this committee has had any documentation submitted to it that would attest

to the health conditions of the cockpit crew member population. It is merely assumed at this point that they are provided 100% fresh air and the statistical incidence of respiratory ailments with the cockpit crew population is at acceptable levels. Further, it is noteworthy to consider that pilots, in contrast to the general population, are subject to frequent medical examinations and are not a true reflection from which data can be interpolated or extrapolated to the general population of air travelers. We will submit herewith relevant standards established by the respective responsible agencies in the United States as they relate to the non-aviation environment (see ex. F). We believe the scientific consensus is that any standard that would apply to the aviation environment would have to be more stringent. It has already been demonstrated that due to the cavalier and seemingly totally unresponsive attitude of the FAA, air quality on board aircraft is, to put it politely, deplorable.

Most people also take for granted, and rightfully so, that they have a right to receive fresh unpolluted air, especially in a captive environment such as an aircraft cabin. As a starting point, it would appear to be prudent to at least accept the most current stringent standards of air quality for the general population in the non-aviation environment as the standard for the aviation environment. These standards should not be based on the U.S. standards necessarily but the most stringent standards available, for instance, in the western world. These standards should be adjusted to reflect the reduced pressure in an aircraft cabin. (The adverse effects of CO and CO_2 are increased at reduced pressure.) Micro-organism maximum levels should reflect what we are commonly used to in the non aviation environment. This matter is often not directly addressed in the non-aviation environment because there is seldom such prolonged congestion as on an aircraft. However, the ASHRAE Standards serve to keep micro-organisms at a minimum.

Subject to further studies, I believe that appropriate standards could evolve that would reflect a healthy environment for all the broad spectrum of people using the international air transport systems which this country, to large degree, has fathered.

In answer to the question concerning the effects of excess levels of, for instance, carbon dioxide, it is interesting to note that, depending on the circumstances, excess levels may range from a few hundred parts per billion to several thousand parts per million. Pressure and oxygen content and the body's ability to utilize oxygen and key components in the establishment of carbon dioxide maximum contamination standards. For instance, divers must use air that is virtually free of carbon dioxide because it poses a hazard to them if the carbon dioxide levels are excessive. However, what is excessive to a diver is not necessarily excessive to the general population. The reason this matter is brought forth is that there may prove to be a similar circumstance in the aviation environment as that confronting the diver, due to the reduced pressure in the aircraft cabin.

Commonly, the reaction to increased carbon dioxide levels manifest themselves in the form of a feeling of being warm and flushed and occasional shortness of breath. The latter is particularly true if the excess levels of carbon dioxide are significantly replacing the oxygen levels in the air that is being breathed. Additionally, excess levels of carbon dioxide will render some people sensitive in their skin to airborne contaminants and even their own clothing occasionally. This sensitivity is usually expressed by itching or scratching oneself. Obviously, as carbon dioxide levels increase, effects may become more pronounced. Carbon dioxide levels on the order of 2% have been demonstrated to be lethal to laboratory animals. The effects of carbon dioxide are well known especially amnong anethesiologists and particularly those physicians involved in the environment on board submarines.

Carbon dioxide is a potent stimulus to respiration. The overall effects of carbon dioxide inhalation increases cardiac output and heart rate and elevates systolic and diostolic blood pressures as well as pulse pressure. Also, persons with heart disease are more prone to cardiac arrhythmias due to inhalation of carbon dioxide.

Depending for the most part on the respiratory health of individuals, exposure to carbon dioxide may vary. Nevertheless, when symptoms appear they are usually manifested by dyspnia, headache, dizziness, sweating, breathlessness, paresthesias and a general feeling of discomfort. After exposure to carbon dioxide some people may experience headache or dizziness. In other words, individuals who may have been exposed to excessive levels of carbon dioxide in a poorly ventilated aircraft encounter headache or dizziness after disembarking from the aircraft to a better ventilated area with lesser concentrations of carbon dioxide.

Excessive levels of carbon dioxide can be eliminated simply by appropriate quantities of fresh air ventilation. Minimum standards in this regard are well established

by ASHRAE and American Conference of Governmental Industrial Hygienists (see exs. D and F).

The foregoing information is readily available from medical text books such as "The Pharmacological Basis of Therapeutics" published by Macmillan Publishing Co., Inc. The deleterious effects of carbon dioxide are well known in the medical community.

Question 7. The FAA testimony sites some examples of proposed minimum ventilation rates for stores, restaurants, lunchrooms, dining halls, etc. These rates are much lower than those you suggest and for that matter those that we find in the cockpit. A figure of 50 cfmp for passengers has been suggested. Presently, the cockpit crew members are provided up to 150 cfmp. Is this difference justified?

OUTDOOR AIR REQUIREMENTS STANDARDS AND PRACTICES
COMPARISON BETWEEN VARIOUS AVIATION AND NON-AVIATION ENVIRONMENTS
RELEVANT TO UNITED STATES SENATE HEARING ON AVIATION HEALTH AND SAFETY ISSUES
(SENATE BILL 1770) MAY 20, 1982

Data on the following graphs are derived and extrapolated from information from the following sources: (in addition to references in text and exhibits).
• American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Standard 62-1981 – "VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY." • Committee on Industrial Ventilation; American Conference of Governmental Industrial Hygienists (ACGIH) • Aerospace Industries Association of America, Inc. (AIA) • Air Transport Association (ATA) • Xenex Corporation. (XENEX)

LEGEND AND NOTATIONS

1 - 12 = ASHRAE Standard 62-1981 – Outdoor Air Requirements for: "Ventilation for acceptable indoor air quality."

= Current Ventilation Rates for Aircraft Cockpits. Includes Smoke Evacuation Capabilities (FAR Requirement)

I = Current Fresh Air Ventilation Practices in Passenger Cabin on Aircraft.

II = Maximum Design Criteria for Fresh Air Ventilation Rates in Passenger Cabin New Aircraft.

III = Maximum Design Criteria for Fresh Air Ventilation Rates in Passenger Cabin Old Aircraft.

NOTE: Federal Aviation Regulations (FAR) require smoke evacuation capabilities for all cockpits. There is no FAR requirement for smoke evacuation capabilities for the passenger cabin. Cockpit crew members have toxic fume protective breathing equipment, occupants of the passenger cabin do not. *(The extremely small per person air space (heavily congested environment) in the passenger cabins of aircraft have previously not been anticipated by minimum health and outdoor air ventilation standards in the non-aviation environment.)

IV–VII = Incorrect ASHRAE Standards as stated by the FAA at the Senate Hearing for: IV-Cocktail Lounge (2), V - Cafeterias (Institutional Lunchrooms) (3), VI-Restaurants/Dining Rooms (4), VII-Stores (9). (Those mentioned in FAA and other Testimony.)

= Suffocation (Noticeable Medical Symptoms).

Physiological principles and respiratory requirements for outdoor air to sealed spaces such as underground shelters are denoted by A, B, B-1, B-2, C and D on the following graphs in this exhibit.

A) Air required to provide necessary oxygen content (ACGIH)
B) Air required to prevent CO_2 concentration from rising above 0.50% (4 cfmp) 0.50% CO_2 = 5,000ppm (ACGIH)
B-1) Air required to prevent CO_2 concentration from rising above 0.25% (5 cfpm) – Ashrae-Sedentary 0.25% CO_2 = 2,500ppm
B-2) Air required to prevent CO_2 concentration from rising above 0.25% (7cfpm) – Ashrae Moderate Physical activity (flight attendants duties exceed the norm for moderate physical activity) 0.25% CO_2 = 2,500ppm
C) Air required to remove objectionable body odors and some, but not all, contaminants eminating from sedentary adults
D) Data in curve C increased by 50% (and projected) to allow for moderate physical activity

• Curves C and D have been extrapolated by dashed lines in order to provide a comparison to the passenger compartment of aircraft.

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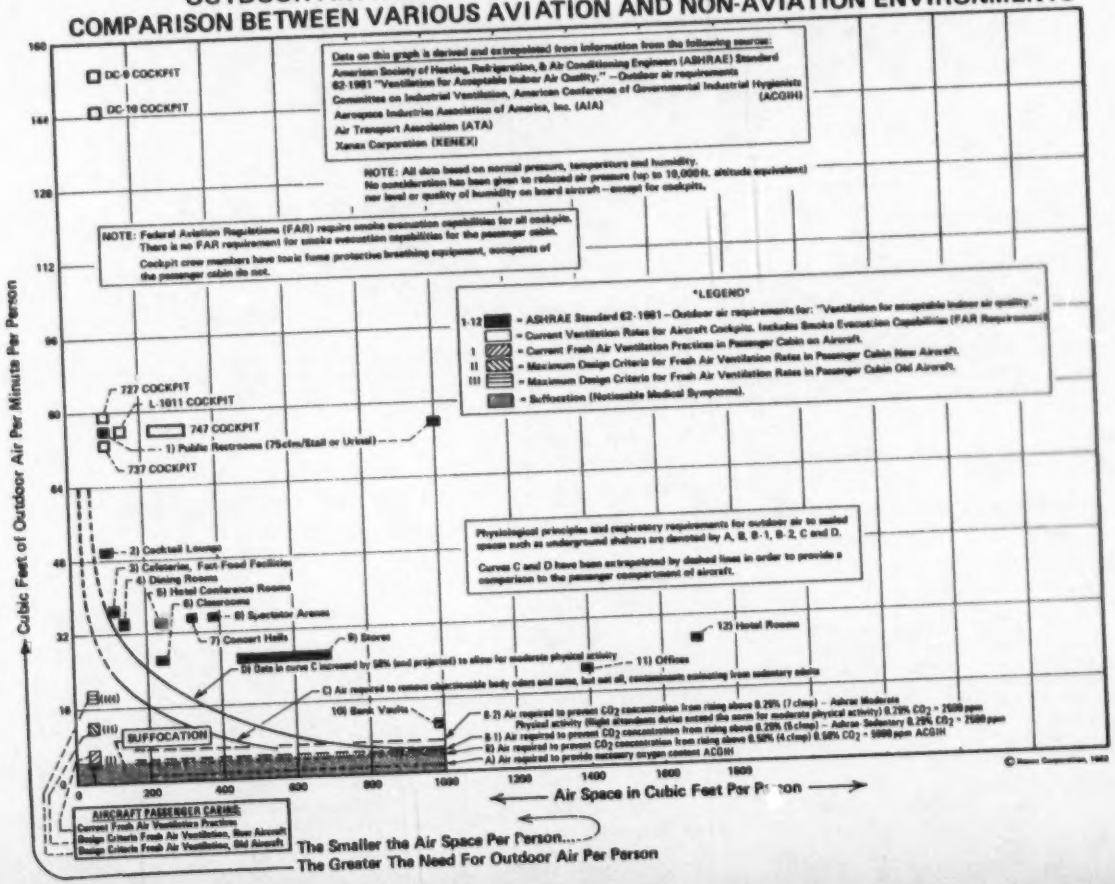
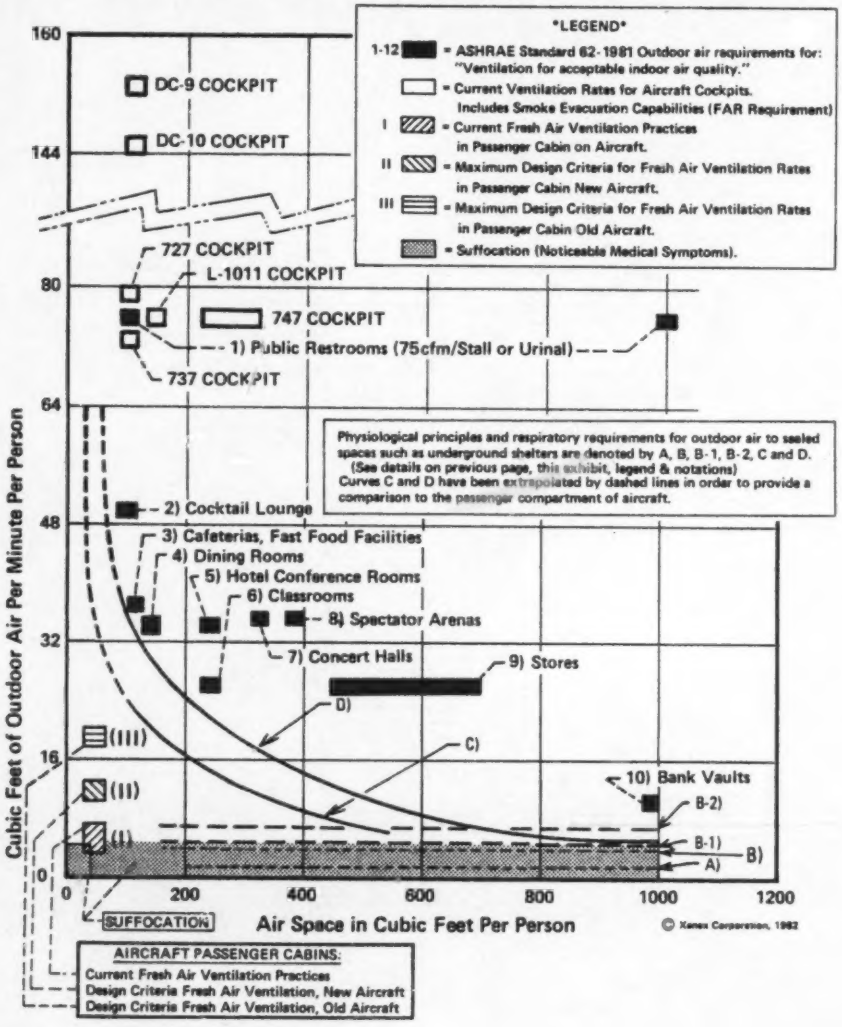
OUTDOOR AIR REQUIREMENTS STANDARDS AND PRACTICES
COMPARISON BETWEEN VARIOUS AVIATION AND NON-AVIATION ENVIRONMENTS


Data on this graph is derived and extrapolated from information from the following sources:
American Society of Heating, Refrigeration, & Air Conditioning Engineers (ASHRAE) Standard 62-1981 "Ventilation for Acceptable Indoor Air Quality." – Outdoor air requirements
Committee on Industrial Ventilation, American Conference of Governmental Industrial Hygienists (ACGIH)
Aerospace Industries Association of America, Inc. (AIA)
Air Transport Association (ATA)
Xenex Corporation (XENEX)
NOTE: All data based on normal pressure, temperature and humidity.
No consideration has been given to reduced air pressure (up to 10,000 ft. altitude equivalent) nor level or quality of humidity on board aircraft – except for cockpits.
NOTE: Federal Aviation Regulations (FAR) require smoke evacuation capabilities for all cockpits. There is no FAR requirement for smoke evacuation capability for the passenger cabin. Cockpit crew members have toxic fume protective breathing equipment, occupants of the passenger cabin do not.
"LEGEND"
= ASHRAE Standard 62-1981 – Outdoor air requirements for: "Ventilation for acceptable indoor air quality."
= Current Ventilation Rates for Aircraft Cockpits. Includes Smoke Evacuation Capabilities (FAR Requirement)
= Current Ventilation Practices in Passenger Cabin on Aircraft.
= Current Fresh Air Ventilation Rates in Passenger Cabin New Aircraft.
= Maximum Design Criteria for Fresh Air Ventilation Rates in Passenger Cabin Old Aircraft.
= Suffocation (Noticeable Medical Symptoms).
Physiological principles and respiratory requirements for outdoor air to sealed spaces such as underground shelters are denoted by A, B, B-1, B-2, C and D.
Curves C and D have been extrapolated by dashed lines in order to provide a comparison to the passenger compartment of aircraft.
DC-9 COCKPIT
DC-10 COCKPIT
727 COCKPIT
L-1011 COCKPIT
747 COCKPIT
737 COCKPIT
1) Public Restrooms (75cfm/Stall or Urinal)
2) Cocktail Lounge
3) Cafeterias, Fast Food Facilities
4) Dining Rooms
5) Hotel Conference Rooms
6) Classrooms
6) Spectator Areas
7) Concert Halls
8) Stores
9) Data in curve C increased by 50% (and projected) to allow for moderate physical activity
10) Bank Vaults
11) Offices
12) Hotel Rooms
C) Air required to remove objectionable body odors and some, but not all, contaminants emanating from sedentary adults
B-2) Air required to prevent CO_2 concentration from rising above 0.25% (7 cfm/p) – Ashrae Moderate Physical activity) 0.25% CO_2 = 2500 ppm
B-1) Air required to prevent CO_2 concentration from rising above 0.25% (5 cfm/p) – Ashrae Sedentary 0.25% CO_2 = 2500 ppm
B) Air required to prevent CO_2 concentration from rising above 0.50% (4 cfm/p) 0.50% CO_2 = 5000 ppm ACGIH
A) Air required to provide necessary oxygen content ACGIH
SUFFOCATION
AIRCRAFT PASSENGER CABINS
Current Fresh Air Ventilation Practices
Design Criteria Fresh Air Ventilation, New Aircraft
Design Criteria Fresh Air Ventilation, Old Aircraft
Cubic Feet of Outdoor Air Per Minute Per Person
Air Space in Cubic Feet Per Person
The Smaller the Air Space Per Person....
The Greater The Need For Outdoor Air Per Person

OUTDOOR AIR REQUIREMENTS STANDARDS AND PRACTICES
COMPARISON BETWEEN VARIOUS AVIATION AND NON-AVIATION ENVIRONMENTS
ENLARGED SECTION OF GRAPH


LEGEND
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Physiological principles and respiratory requirements for outdoor air to sealed spaces such as underground shelters are denoted by A, B, B-1, B-2, C and D. (See details on previous page, this exhibit, legend & notations)
Curves C and D have been extrapolated by dashed lines in order to provide a comparison to the passenger compartment of aircraft.
DC-9 COCKPIT
DC-10 COCKPIT
727 COCKPIT
L-1011 COCKPIT
747 COCKPIT
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1) Public Restrooms (75cfm/Stall or Urinal)
2) Cocktail Lounge
3) Cafeterias, Fast Food Facilities
4) Dining Rooms
5) Hotel Conference Rooms
6) Classrooms
8) Spectator Arenas
7) Concert Halls
9) Stores
10) Bank Vaults
D)
C)
B-2)
B-1)
B)
A)
(III)
(II)
(I)
SUFFOCATION
Cubic Feet of Outdoor Air Per Minute Per Person
Air Space in Cubic Feet Per Person
160
144
80
64
48
32
16
0
0
200
400
600
800
1000
1200
AIRCRAFT PASSENGER CABINS:
Current Fresh Air Ventilation Practices
Design Criteria Fresh Air Ventilation, New Aircraft
Design Criteria Fresh Air Ventilation, Old Aircraft
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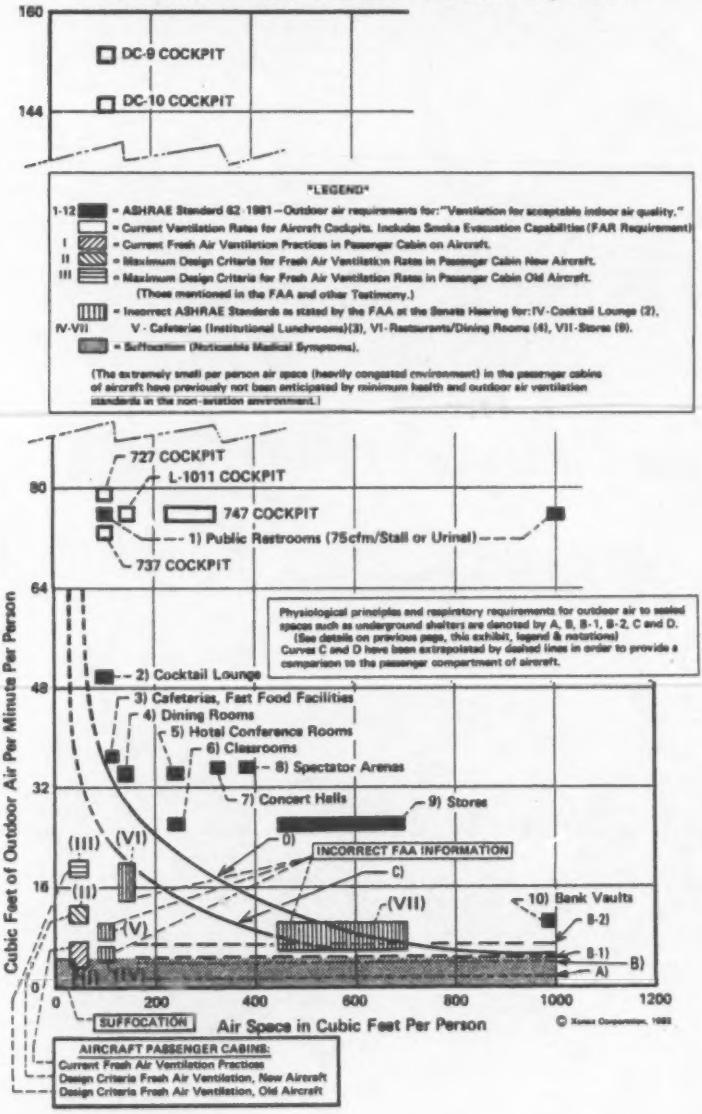
OUTDOOR AIR REQUIREMENTS STANDARDS AND PRACTICES COMPARISON BETWEEN VARIOUS AVIATION AND NON-AVIATION ENVIRONMENTS ENLARGED SECTION OF GRAPH

SHOWING INCORRECT STANDARDS AS STATED BY THE FAA AT U.S. SENATE HEARING (S-1770) MAY 20, 1982


160
144
DC-9 COCKPIT
DC-10 COCKPIT
"LEGEND"
1-12 = ASHRAE Standard 62-1981—Outdoor air requirements for: "Ventilation for acceptable indoor air quality."
= Current Ventilation Rates for Aircraft Cockpits. Includes Smoke Evacuation Capabilities (FAR Requirement)
I = Current Fresh Air Ventilation Practices in Passenger Cabin on Aircraft.
II = Maximum Design Criteria for Fresh Air Ventilation Rates in Passenger Cabin New Aircraft.
III = Maximum Design Criteria for Fresh Air Ventilation Rates in Passenger Cabin Old Aircraft.
(Those mentioned in the FAA and other Testimony.)
= Incorrect ASHRAE Standards as stated by the FAA at the Senate Hearing for: IV - Cocktail Lounge (2).
IV-VII V - Cafeterias (Institutional Lunchrooms)(3), VI - Restaurants/Dining Rooms (4), VII - Stores (9).
= Suffocation (Noticeable Medical Symptoms).
(The extremely small per person air space (heavily congested environment) in the passenger cabins of aircraft have previously not been anticipated by minimum health and outdoor air ventilation standards in the non-aviation environment.)
727 COCKPIT
L-1011 COCKPIT
747 COCKPIT
1) Public Restrooms (75cfm/Stall or Urinal)
737 COCKPIT
80
64
48
32
16
0
Physiological principles and respiratory requirements for outdoor air to sealed spaces such as underground shelters are denoted by A, B, B-1, B-2, C and D. (See details on previous page, this exhibit, legend & notations) Curves C and D have been extrapolated by dashed lines in order to provide a comparison to the passenger compartment of aircraft.
2) Cocktail Lounge
3) Cafeterias, Fast Food Facilities
4) Dining Rooms
5) Hotel Conference Rooms
6) Classrooms
8) Spectator Arenas
7) Concert Halls
9) Stores
(III)
(VI)
D)
INCORRECT FAA INFORMATION
C)
(II)
(VII)
10) Bank Vaults
B-2)
(V)
B-1)
B)
(I)
(IV)
A)
Cubic Feet of Outdoor Air Per Minute Per Person
0
200
400
600
800
1000
1200
SUFFOCATION
Air Space in Cubic Feet Per Person
AIRCRAFT PASSENGER CABINS:
Current Fresh Air Ventilation Practices
Design Criteria Fresh Air Ventilation, New Aircraft
Design Criteria Fresh Air Ventilation, Old Aircraft

Answer. Prior to reading our answer to this question we would encourage the Senators to review the chart which immediately precedes this question, entitled "Outdoor Air Requirement Standards and Practices—Comparison Between Various Aviation and Non-Aviation Environments" (see ex. D). This chart clearly shows, based on per person available airspace and quantity of outdoor air per minute per person that current airline practices of providing approx. 5 cu. ft. per person per minute is closer if not bordering, on the suffocation levels than it is to even meeting the minimum health standards established in the non-aviation environment.

As shown in the chart current outdoor air ventilation for the passenger cabin of an aircraft is much less than the minimum standards of a cocktail lounge. Based on the Ashrae Standards 62-1981 for "Ventilation for Acceptable Indoor Air Quality". The reason we say "much less than is the fact that the occupancy density on the aircraft as can be seen on the chart, is approximately two to three times that of the cocktail lounge (ASHRAE minimum standard outdoor air for cocktail lounge, smoking permitted is 50 cfm/person). In other words, on an aircraft the per person available air space may be as low as 35 cu. ft. whereas in a cocktail lounge it's most often in excess of 100 cu. ft. per person. Therefore, it appears that the fresh air ventilation stnds. on board aircraft may be, in fact, only 1/15th of 1/20th of that for a cocktail lounge with a similar occupancy density and per person available air space so, for the FAA to site the ventilation rates for stores, lunchrooms, dining halls, etc. without making adjustment to occupancy density and per person available air space is totally unjustified and misleading. Not only that, we think it is apparent to anybody after reviewing the aforementioned charts and being privy to the facts, that the FAA statements are nothing but disturbing displays of incompetance or wilful deceit.

In answer to your question whether or not the difference between 50 cu. ft. per minute per passenger of fresh air as compared to 150 cu. ft. of fresh air per minute per person for the cockpit crew, is justified, our answer to this is NO. It is not justified other than from a standpoint that there is a greater need for visibility for the pilots both externally of the aircraft as well as internally to view instruments, in the event of a smoke and fire emergency. It is obviously not necessary for the passengers to view instruments nor to have outside visibility for the purpose of attempting to safely land an aircraft in emergency conditions. (Visibility is, however, most helpful to passengers when evacuating an aircraft.)

The 150 cfmp of fresh air for the cockpit is not necessary for equipment cooling. Appropriate cooling of cockpit equipment is accomplished with far less than even 50 cfmp which has been the suggested fresh air ventilation rate for the passengers. Actually, the amount of air required for equipment cooling in the cockpit commonly range from 5 to 20 cfmp depending on the temperature of the air and the amount of equipment in the cockpit.

To properly answer whether or not the difference between 50 cfmp and 150 cfmp is justified, one would have to consider philosophical as well as economic issues.

150 [1] cfmp is primarily provided for the purpose of adequate smoke evacuation within safe pressurization limits. However, one should bear in mind that the same toxic fumes that may impair the visibility for the pilots and thereby jeopardize the overall safety of the aircraft may be lethal to the passengers. This argument would prompt the question why would the toxic fumes be lethal to the passengers and not to the pilots? The answer is that pilots have toxic fume protective breathing equipment. So, the only additional worry from the standpoint of safety for the operation of the aircraft is pilot visibility. Whereas, the occupants of the passenger cabin are provided no toxic fume protection whatsoever (nor for that matter any instructions of what to do in the event of such emergencies).

It is well known among experts and laymen alike that it is not necessary to have such high concentrations of toxic fumes as to obscure visibility in order for the toxic fumes to be lethal.

We would, therefore, conclude (by reasons of commonsense) that in the absence of any toxic fume protective breathing equipment for the passengers, 150 cfmp of fresh air per occupant in the passenger cabin may not be even sufficient in order to provide an equal amount of respiratory protection against toxic fumes for the occupants in the passenger cabin as compared to the occupants of the cockpit. In contrast, however, there may be some justification for the difference between 50 cfmp for the passenger cabin and 150 cfmp for the cockpit, if toxic fume protective breathing equipment is provided, especially if it also affords protection for the entire head of the occupants. Protection for the entire head is necessary in order to protect the eyes which oftentimes can be damaged from toxic fumes as well as the

[1] 70 cfmp for health reasons.

areas in the inner ear which can be affected by toxic fumes and consequently impair the exposed individual.

Question 8. In your testimony you dictate that cabin pressurization may, in some cases, be as low as the equivalent of 9,000 feet altitute. However, the FAA states that current FAA regulations for pressurization require that the cabin altitude not exceed 8,000 feet for pressurized airplanes. How is this possible? Please also indicate the basis for your response.

Answer. The basis for our response is simply the Federal Aviation Regulations and measurements we have made. In the operating rules of the Federal Aviation Regulations Part 121 there are no requirements that state that a pilot must operate the aircraft with a cabin pressure not in excess of 10,000 feet.[1]

There is a design requirement in the Federal Aviation Regulations in Part 25, Par. 25.841 which states that the aircraft must be capable of providing a "cabin pressure altitude of not more than 8,000 feet at the maximum operating altitude of the airplane . . ." If this had any meaning from the standpoint of actual operation of the aircraft, in other words, the pilots were never allowed to exceed the 8,000 feet cabin altitude limit, then one would assume there would be, for instance, a warning sign or bell to alert the pilots and at, for instance, 7,500 feet cabin altitude, however, this is not the case.

In Par. 25.841 (6) there is called for a warning indication "when the cabin pressure altitude exceeds 10,000 feet". Again, this is only a design regulation. It does not mean that pilots have to heed the warning indication. There is no such requirement in the Federal Aviation Regulations Part 121 which are the operating rules. To add insult to injury, the limit is not 10,000 feet. The limit supposedly is that at 14,000 feet the oxygen masks are automatically deployed. Dropping the oxygen masks is the only indication (by legal requirement) that a passenger would have of the fact that the cabin altitude is then at 14,000 feet, in other words, almost twice the 8,000 feet referred to be FAA at the hearings.

Question 9. You indicate in your testimony that a study or studies have been conducted which show that a percentile basis 6 to 7 out of every 100 air travelers with recent heart attacks or similar problems, die within 4 days of air travel. Yet at the same time we have been told in testimony at this hearing that only approximately 50 people per year die in flight. I know there are a lot of people in this country with heart problems and based on the study or studies that you cite this matter obviously deserves attention, however, I am still wondering why there could be such a low number of fatalities in flight and obviously I am curious about what the possible or contributory causes of death could be. Is there any more information you could provide us in this area? If so, please provide the information to the Committee.

Answer. 50 fatalities in flight in a year may not be a number that is true to fact. The issue is in all likelihood one of a technicality of when a person is pronounced dead. A person may very well be dead on a plane but not pronounced dead until he or she is brought to a medical facility, on the ground. We believe it's most appropriate to establish a medical data base so that true verifiable numbers can be arrived at in order to provide adequate risk assessment as well as possible remedies.

The possible contributory causes of death in flight and post flight so far appears to be low cabin pressure, excess levels of carbon dioxide, carbon monoxide, fear and, of course, as stated in questions and studies that were previously cited, impaired physical abilities primarily cardiac and respiratory. Last, but not least is pathogenic air contamination.

Following is a brief elaboration on the possible contributory causes.

Low pressure causes oxygen deficiency, in other words, the amount of oxygen in the same volume of air which we would breath at sea level is less at the low pressures encountered at high altitude. Therefore, the heart is forced to increase its rate in order to compensate to provide an equal amount of oxygenated blood to the vital areas of the body. Therefore, even though a person may be sedentary for several hours, the heart is experiencing perhaps an equivalent rate of work to that of a person walking rapidly or in some cases, even jogging slowly. This dilemma obviously becomes more pronounced the longer the flight is. Many people are not used to walking for 5, 8, 10, 12 or 14 hours.

Just like an untrained person would acquire muscle pain particularly the day after strenuous exercise, the heart may be experiencing a similar delayed reaction. This then may be one of the causative factors in post flight mortality of persons with ischemic heart disease, especially infants and elderly. The reasons are not well understood presently.

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[1] Higher cabin altitute—lower cabin pressure.

The deleterious effects of carbon dioxide were explained in our response to Question No. 6. Excess levels of carbon dioxide may be contibutory causes to mortality.

The effects of carbon monoxide on man, at other than normal pressures, have also been documented, however, these investigations have, for the most part, been directed to special applications for special individuals in the submarine and space environment. In our opinion, there have not been adequate studies conducted to permit a conclusive statement as to the appropriate maximum carbon monoxide levels at certain reduced air pressures as may be encountered by the general population on board aircraft at high altitudes. Studies should be conducted since carbon monoxide is known to displace the oxygen carrying capacity of a person's blood. This decreased capacity for transmission of oxygen may also contribute to inflight and post flight death of patients with ischemic heart disease.

The contribution of the fear of the unknown or the fear of flying or the sudden fright that an unaccustomed air traveler with heart disease may encounter, should not be underestimated as causative factors as well. We believe in this regard that airlines, not all, but a fair number of them, have recognized the value from health, safety and public relations viewpoints of endeavoring to inform the traveling public in the course of a flight of potentially frightening noises, or other disturbances caused by turbulence. In addition, the medical community is cognizant of the fear or fright factor and, as we understand, generally recommends light chemotheraputic treatment such as ordinary tranquilizers to reduce possible adverse effects.

Impaired physical health, especially cardiac and respiratory health are well recognized in the medical community as contra indications to air travel today. However, that may not have been the case as recently as a few years ago. We believe this area of study deserves consideration in order to arrive at a total risk assessment as it concerns contributory cause of death in connection with air travel.

Pathogenic air contamination especially at low air pressures and low relative humidity, as in an aircraft cabin, may contribute substantially to mortality of individuals particularly those with impaired health. One of the obvious scenarios is an individual contracting pneumonia which several weeks later may lead to cardiac and respiratory failure. Testimony before this committee has already demonstrated that the bacteriological counts on board aircraft are exceedingly high. Certainly much higher than anticipated by the FAA and others who profess that there is no problem whatsoever of any contamination on board aircraft. The extent or percentage contribution of pathogenic air contamination, and for that matter, impaired immunological respiratory functions due to low relative humidity is unknown and certainly deserves investigation.

Other contributory causes of death could be any combination of the aforementioned several factors but should not be limited thereto. Since this is a new area of investigation, we are confident that researchers will keep an open mind and not exclude such issues as combustion by-products from burning tobacco (other than CO), ozone etc.

Question 10. It appears that some of the parties testifying at the hearing regard ozone contamination and contamination by tobacco smoking as separate from the air quality issues raised in S. 1770. Do you believe that these issues can be separated from the general issues of the bill?

Answer. Absolutely not. Ozone and tobacco contamination are merely the tip of the iceberg of the contamination and air quality problems. The Senate Bill addresses all air contamination and should therefore incorporate to study whether or not ozone contamination limits as now set by regulation are adequate and meaningful in practice, likewise with the ever growing concern of the hazards of tobacco smoke, we can see no sensible reason to exclude the smoking issue from studies proposed under Senate Bill S. 1770.

As it concerns the issue of tobacco smoking and the passive effects on non-smokers, the initial studies on this matter have been conducted by researchers J. L. Repace and A. H. Lowrey entitled "Tobacco Smoke, Ventilation, and Indoor Air Quality." (See ex. K.)

Addressing directly "the problem of passive smoking" James L. Repace, Office of Policy Analysis United States Environmental Protection Agency, Washington, D.C., published in the Bulletin of the New York Academy of Medicine, Volume 57, No. 10, December 1981, Mr. Repace clearly notes that "Tobacco-smoke-polluted indoor air is a matter to deal with under the criteria of indoor air quality. This further supports the contention that tobacco smoke issue cannot be removed from the general considerations concerning outdoor ventilation for acceptable indoor air quality.

To amplify the conclusions of the preceding paragraph, and the serious problems concerning air contamination on board aircraft, I am attaching immediately following this response in Question No. 10, a synopsis of "Physician's letter." Some very

grave and disturbing facts are conveyed, not only in the "Physician's letter" but also in the fact that the letter itself is being withheld from the record (and only a synopsis provided) due to possible adverse effects caused by the incriminating statements in the letter.

Question 11. The FAA says that there is no demonstrated need from a health standpoint to humidify cabin air. You have indicated your disagreement with this contention suggesting that the studies or tests that the FAA cited were inappropriate and inaccurate as a comparison to the aviation environment. Could you provide us some further information of what, from a health standpoint, the relative humidity level should be? Please indicate and identify your reason forming the basis of your answer to this question.

Answer. To begin with, the FAA has been apprised of the misleading comparison when they cite a study entitled "Human Response to 78 Hour Exposure to Dry Air" (see ex. Z). Xenex Corporation advised the Administrator of the FAA in a letter dated September 30, 1980 (essentially two years ago). We quote: "As the FAA already knows the experiments referred to by the Aerospace Industries Association provided for 73 cfmp of pure fresh air to the subjects, 9%RH virtually, no dust, etc. In the concluding remarks, the researchers caution the reader of the limitations of their findings. It is obvious that their findings do not apply to an aircraft cabin which is ventilated with a hazardously low fresh air ventilation rate of 5–7 cfmp and where the moisture in the air on board is 95% sweat and breath from occupants (in contrast to the sterilized vapor used in the experiments).

We think the foregoing should sufficiently apprise the Senators of the fact that the study referred to by the FAA has no bearing vis-a-vis the allegations made in our prior petition, nor can the study serve as justification to humidify aircraft almost exclusively by means of the unsterilized sweat and breath of occupants on board. The suggestions made by the FAA would never stand up for even a cursory scientific review, especially as it concerns what is happening in real life on board aircraft.

In answer to the question "of what, from a health standpoint the relative humidity level should be?" it is clearly documented in Exhibit H and in our response to Question No. 1 that relative humidity levels of 35 to 50% are recommended from a health standpoint. I will take the liberty to quote briefly from Exhibit H. "A linear correlation between indoor relative humidity and percent absenteeism was obtained in twelve Saskatoon public schools, showing a 20% reduction in all absenteeism as average relative humidity during school hours was increased from 22 to 35%. Results were supported by data obtained in six Halifax, Nova Scotia public schools, a Swiss Kindergarten, and in American army barracks. Sufficient evidence leads to the conclusion that there is a significant reduction in respiratory disease with an increase in relative humidity of occupied spaces. This paper was presented during ASHRAE's 1974 Annual Meeting in Montreal."

The results of the study were presented by George H. Green, Member ASHRAE, Professor, Department of Mechanical Engineering, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, at the annual ASHRAE meeting in Montreal, 1974 (see ex. H).

In addition to the foregoing researchers who have published material in the ASHRAE Publications recognize a 50% RH as being most suitable from a health standpoint. (See our response to Question No. 1). The effects of relative humidity on health are well recognized in the medical community—especially if the moisture is clean it is beneficial.

Question 12. The FAA cites in their testimony "ASHRAE Standard for Passenger Transport Aircraft." If, in fact, there is such a standard, established by a prestigious and recognized organization, why are we here discussing the fresh air ventilation issues, if in fact, as the FAA seems to imply, these issues have been adequately resolved?

Answer. These issues have been more than adequately resolved except in the minds of the Administrator and a handful of representatives from industry. Minimum outdoor ventilation standards are established in virtually every environment we are subjected to in the non-aviation environment (see ex. F). ASHRAE 62-1981 Outdoor Air Requirements for "Ventilation For Acceptable Indoor Air Quality" (see ex. D). The problem, however, is that there are neither operating nor specific design standards and regulations for the passenger compartment of transport aircraft. We have repeated this many times. We also wish to clarify that there is NO "ASHRAE Standard for passenger transport aircraft" in contrast to what the FAA is trying to make the Senators believe. I will take the liberty to again quote from Exhibit A which is a letter dated June 18, 1982 from Mr. G. F. Hohn, Manager of Standards, American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

". . . the recommended ventilation values given in Chapter 9 of ASHRAE Handbook 1978 Applications have not been standardized by ASHRAE. That is, they have not been incorporated in one of our standards, particularly Standard 62, "Ventilation for Acceptable Indoor Air Quality" which are arrived at by a consensus process".

Chapter 9 of the ASHRAE Handbook is what the FAA repeatedly has been citing incorrectly as an adopted Standard by ASHRAE.

The FAA previously has been advised about this fact. In light of this, one must seriously question the credibility of the FAA for wilfully presenting this erroneous information to the Senators of this Committee.

So, to conclude my answer to your question, the issues have been adequately resolved and need only be implemented for the health and safety of the traveling public on board aircraft. Why the FAA is opposing this fundamental and commonsense fact is beyond comprehension. In fact, we believe their actions border on willful negligence.

XENEX CORP.,
Honolulu, Hawaii, August 14, 1982.

Hon. DANIEL K. INOUYE,
Russell Senate Office Building, Washington, D.C.

DEAR SENATOR INOUYE: This is in answer to the June 21 letter which inquired whether we would care to make additional comments concerning the May 20, 1982 hearing on S. 1770.

We understand our responses, with accompanying exhibits, will be made part of the record of the Aviation Health and Safety Bill S. 1770 hearing. Enclosed hereto are the Xenex Corporation comments to the question you pose.

In closing we would like to emphasize the importance of your opening remarks at the May 20, 1982, Senate hearing on S. 1770. An air common carrier of passengers, according to current case law, he said, is under an obligation to exercise either a high or the highest degree of care for the safety of its passengers. Unfortunately the Federal Aviation Administration (FAA) has neglected to promulgate meaningful safety and health regulations and failed to update current regulations and policy as required by a changing of the state of the art.

In reliance on these regulations and practices, the airline industry appears to be confronted by serious and extensive liability for complying with outdated or nonexistent FAA regulations and the absence of appropriate minimum safeguards in the face of historically well-recognized safety and health hazards to the public and airline employees.

It is, I believe, in the best interest of the safety, health, and welfare of the flying public and the airline industry that S. 1770 becomes public law.

Again, we thank you for the opportunity to be of service to the Senate and this Subcommittee.

Sincerely,

BERTIL WERJEFELT, *President.*

Question. "As a witness at the May 20th, 1982 hearings on S. 1770 by the Senate Subcommittee on Aviation, you heard first hand the comments made by other participating witnesses Would you care to make additional comments concerning the testimony received that day? Please substantitate your comments."

Answer. It is most appropriate at this time to put the pro and con arguments concerning S. 1770 into historical perspective. This is especially true in light of the apparent negligence and seeming wilfully misleading statements made by the FAA. (See exs. A, D, G, O, and X; and answer to question 1.) The following historical analogy concerning the epidemiology of cholera and typhoid fever are most appropriate and helpful for his purpose.

In the early and mid 1800's Europe, Asia and the Americas had severe pandemics of cholera and typhoid fever causing tens of thousands of fatalities. At that time no one knew the cause of these serious diseases. After several decades of outbreaks it was discovered that polluted drinking water was the causitive factor. The subsequent need for water purification was made obvious through studies by two men, John Snow, working in the 1850's and Robert Koch in the 1880's and 1890's.

The importance of drinking water as a vehicle for the spread of cholera was first shown by Snow, a British physician, even without any knowledge of the bacterial causation of the disease. (Snow's study is one of the great classics of epidemiology and is often cited in basic textbooks on the subject.) Snow demonstrated that cholera was transmitted in two ways, by person to person contact (which by todays definition is accomplished within 3 feet of a deceased individual i.e. without physically

touching an individual) and by polluted drinking water. His most famous study relates to the great cholera out break in London in 1853 and 1854. During that time water supplies to different parts of the city were from different sources. In areas of the Thames River the water supplied to homes by two competing private water companies, the Southwark and Vauxhall Company and the Lambert Company. Snow made a careful study of the incidence of every death in the district served by the two water companies. In one particular area the two companies competed directly, each running independent water pipes along the streets, permitting each home to be supplied by either company. Snow's study was so astonishingly clear-cut that it even convinced those skeptical about the importance of polluted water in the transmission of cholera. The death rate per 10,000 inhabitants supplied by the Southwark and Vauxhall Co. were approximately ten times higher than its competitor. It was later demonstrated that the Southwark and Vauxhall Co. obtained its water from the Thames in the center of London where sewage contamination was greatest. Whereas the Lambeth Co. obtained its water from a part on the river above the city where the water was relatively free of pollution. Although Snow, in his case, had not provided a sample or for that matter was even knowledgeable of the bacteria causing the disease (this was discovered several decades later) his statistical proof was sufficient.

I am sure the owners and directors of the Vauxhall Co. vehemently objected and opposed the serious and incriminating evidence presented to them and the public. It appears to be no different today with the FAA as it concerns air quality and the related issues of Sen. Bill 1770. In the face of overwhelming evidence indicating serious problems, some of which are resulting in fatalities, the FAA along with a small handful of supporters who they are supposed to govern, are attempting to tell us that they have studied the matter sufficiently and that there is no need for any further studies, nor corrective measures. This posture by the FAA is under the circumstances appalling.

Commonsense tells us that if we suspect or know that some travelers are contracting respiratory disease, encountering serious heart problems and most long distance travelers suffer from jet lag (perhaps costing this nation billions of dollars) and that the environment on board the aircraft is the suspected source of the medical afflictions—then obviously studies and appropriate corrective measures should be initiated.

Whether or not the Vauxhall Co. owners liked it, rules, regulations and standards were implemented for water purification in order to rid several continents of the ravages of cholera and typhoid fever. Today, it is an accepted fact of life and taken for granted that the water we use in our homes and public places is purified and free from harmful or pathogenic contaminants.

Various harmful contaminants i.e. pathogenic virus and bacteria can also be spread through the air. The risk of infections is greatly increased in poorly ventilated and congested areas. This is as well known as the fact that polluted water will make people sick.

Due to the risk of the spread of airborne diseases thru the air and, for that matter, person to person contact in the enclosed environments of our daily lives, society, over the last 5 or 6 decades, has established appropriate outdoor air ventilation requirements, or fresh air requirements, as it is commonly called, for acceptable indoor air quality in order to reduce and avoid the spread of harmful and lethal disease. This is a fundamental fact of life in the western world and is taken for granted—rightfully so.

The FAA is attempting to exempt itself from this basic responsibility vis-a-vis the public and the people employed in the industry it is supposed to govern. Considering the facts, the actions of the FAA (or lack thereof) is, in our opinion, nothing short of willful dereliction and premeditated negligence. Of all of us, currently there is only a handful of opponents to the Senate Bill. I am sure they will now reconsider their position in a historical perspective and with due consideration to the current facts and serious health and safety problems that are reflected in this hearing record. The fact that a few people or organizations have opposed the establishment of minimum health and safety standards may, in part, be due to insufficient indepth knowledge about the subject matters of the Senate Bill. This is understandable since the subject matter may not be directly in their line of business. However, it is most disturbing and inexcusable that the federal agency which is by law supposed to promote the aviation industry and protect the safety of the air traveling public seemingly does not prossess the wherewithall nor the will to do part of the job it was chartered to do. In fact, it appears those they govern are more knowledgeable to the true facts and serious problems than the FAA.

The fact that some representatives within the industry disagree as to the appropriate action should be totally irrelevant to the duties of the FAA, which is to determine the facts and promote safety. The safety measure is, and always will be: To insure that the air travelers arrive at their destinations in the same condition as when they embarked on their journey, not, we submit, merely to attempt to get them there alive, which is the current FAA posture and standard!

With the foregoing perspective, I will, on the following pages, provide a brief commentary on the relevant issues listed in the Senate Bill and discussed at the hearing May 20, 1982.

We regret any inconvenience it may cause the Senators in our repeating the stated purposes of the Bill throughout the following text, however, as we have stated before, we believe it is necessary since the FAA repeatedly quotes out of context or, for that matter, at times does not even address the issues. This is particularly true as it concerns the matter of "promoting and maintaining a superior aviation industry & whether or not the current practices on board aircraft are discriminatory from a health and safety standpoint". The FAA conspicuously avoided any discussions concerning the health and safety issues and whether or not there are discriminatory practices. (In our opinion, the Watergate scandal pales in comparison to deleterious effects on the 300 million air travelers in this country, due to the inaction, negligence and what appears to be the FAA's outright efforts to cover up the true facts.)

The FAA has not conducted adequate studies as it concerns the matters of Senate Bill S. 1770. The FAA is relying on their response concerning FAA Regulatory Docket 20351 (Petition for rulemaking) which Xenex Corp. has demonstrated to be totally invalid and unjustified (see our response to Question 1). In addition, they are misquoting the law and misleading the Senators concerning current practices of fresh air ventilation on board aircraft.

(1) The Senate Bill seeks to promote and maintain a superior aviation industry and in so doing it seeks to determine whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are non-discriminatory and at least in conformance and parity with non-aviation standards, practices and regulations (including de facto circumstances) as it concerns: (1) "Quantity of fresh air per occupant and over all quality of air on board."

Several of the witnesses at the hearing, including Xenex Corp., have presented overwhelming evidence that the air quality on board aircraft is deficient both in practice and by design (see ex. D). It has also been demonstrated that the quantity and quality of air on board aircraft is provided with discrimination in the face of known health and safety hazards. Further, it is demonstrated that passengers and employees are contracting illness and disease due to the deficient air quality on board some aircraft. The need for studies is obvious. For the FAA to say otherwise certainly indicates that it cannot be accused of vigorous leadership and foresight. Clearly the FAA is negligent in its actions (or lack thereof).

To further amplify our position vis-a-vis the FAA, I would like to quote the following from a letter dated July 22, 1982 received by the Xenex Corp. from John N. Deutschlander, Marketing Manager, Sierra Monitor Corp.

"As I mentioned, since I carried a Model 50 with me on that extended trip, I had the opportunity to take some measurements of oxygen deficiency on four separate flights. I took only a few measurements during the flight at cruising altitude, preferring to focus more on the quality of the cabin air prior to take-off and just prior to landing. Readings were taken at about one-minute intervals during boarding and while awaiting take-off clearance. With this instrument, I was able to read directly percent oxygen and atmospheric pressure (in mm of mercury).

"I was surprised to hear the Model 50 alarm, indicating that the oxygen level had fallen to 19.5%. At a few points, it actually dropped to 19%, which was equivalent to a 10% dilution of air. I mention this because I have encountered knowledgeable people who assume that a 1.5–2% drop in oxygen percentage is relatively insignificant. If the air diluent is a toxic gas like carbon monoxide, then 10% is highly lethal. If it is a flammable gas like methane, 10% is highly explosive."

One can sensibly ask, what is required for the FAA to recognize these problems and take some constructive action? A planeload of seriously ill people? A number of conspicuous sensational fatalities? We have already abundantly demonstrated that there are problems.

Yet, the FAA tells the Senators and the public that they are not aware of any problems. This is preposterous! There are serious problems and discriminations. The record and testimony clearly substantiate the need for studies, as well as immediate corrective action on many of the problems.

(2) The Senate Bill seeks to promote and maintain a superior aviation industry and in so doing it seeks to determine whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are non-discriminatory and at least in conformance and parity with non-aviation standards, practices and regulations (including de facto circumstances) as it concerns: "Quantity and Quality of Humidification.

Several witnesses, including Xenex Corp., have provided ample evidence that the quality and quantity of humidification is, to put it politely, deplorable. This fact is abundantly substantiated in the hearing record at this time. Again, on this issue, the FAA is also burying its head in the sand, instead of correcting the problem, which is what they are chartered to do and being payed for.

(3) The Senate Bill seeks to promote and maintain a superior aviation industry and in so doing it seeks to determine whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are non-discriminatory and at least in conformance and parity with non-aviation standards, practices and regulations (including de facto circumstances) as it concerns: "Air contamination limits."

Although the FAA disagrees, it is also unequivocably demonstrated that in actual practice serious discrimination occurs in this area. Some occupants on board aircraft are provided 100 percent fresh air while at the same time others are given heavily contaminated air, in the face of known and recognized hazards, contaminated air is still being provided, in many cases, to unsuspecting air travelers who are captive and powerless to change the deleterious circumstance. Again, on this issue the FAA does not have any meaningful regulations concerning air contamination limits as they apply to the general air traveling population. The testimony in the hearing record abundantly attests to serious contamination of the air on board aircraft and consequently the need for establishment of maximum contamination limits, subject to studies. The FAA objections to studies is, under the circumstances, incomprehensible and negligent.

(4) The Senate Bill seeks to promote and maintain a superior aviation industry and in so doing it seeks to determine whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are non-discriminatory and at least in conformance and parity with non-aviation standards, practices and regulations (including de facto circumstances) as it concerns: "Emergency Breathing Equipment including Toxic Fume Protective Breathing Equipment."

This is one of the most conspicuously neglected arears by the FAA. I would venture to say that millions of dollars have been spent by the FAA concerning the toxic fume hazards on board aircraft in flight. The FAA has been aware of the toxic fume hazards for more than two decades. Yet, today there is not even a simple instruction for passengers of what to do in the event of such in flight emergencies. I am personally disgusted to hear the FAA advocate, under the guise of "fiscal prudence", that neither studies nor corrective action is necessary. The FAA has spent decades and millions of dollars without even producing a simple emergency placard concerning in flight smoke and fire emergencies. It appears the FAA may be the most deservant candidate for "Senator Proxmire's Golden Fleece Award". I would personally contribute an award for gross negligence and dereliction. That the FAA is deservant of these awards is even more painfully clear when one discovers that there have been more than 3,000 aircraft fire, smoke and fume occurrences over the last five years (that is approx. 600 per year) and in one recent period, it is estimated that more than 600 people were asphyxiated in little more than a year, all on American made aircraft!

To render perspective on the just cited statistics; 600 fire, smoke and fume occurrences per year is a serious safety issue because it indicates that approximately every 10th aircraft encounters such a hazard once a year.

It would be most appropriate for the FAA to address itself to the issue of safety as it concerns the percentage of this nation's air fleet that is affected, rather than on the basis of the misleading figures of relating flight safety to number of take offs and landings or passenger miles traveled. This method of safety assessment is hardly exercised anywhere else and for that matter neither do the insurers of the nation's aircraft give such statistics other than a passing thought. The insurance companies are concerned with the potential hazards as it relates to the aircraft fleet. The number of aircraft involved in i.e. fire smoke and fume occurrences should be related to the total number of aircraft in the fleet in order to provide meaningful statistics for health and safety risk assessment; not the number of take-offs and landings or passenger miles flown.

Conclusively, toxic fume protective breathing equipment is provided discriminately to the occupants on board aircraft! Most, if not all, passengers (and some crew and FAA staff) mistakenly believe the oxygen masks are useful for smoke and toxic fume protection. This is not true. The false belief that the air traveling public harbors, thinking that the oxygen masks are smoke masks, is perhaps one of the major reasons why the FAA is not even providing any information on the emergency cards (in the seat pockets) of what passengers should do in the event of an inflight smoke or fire emergency!

Thus, there is obvious discrimination in providing toxic fume protective breathing equipment. Such equipment is provided for the pilots for their protection, nothing is provided for the passengers!

Attached as exhibit Z8 are some sketches describing a new and economical system for toxic fume protective breathing equipment, developed by Xenex Corp. Brochures and specifications will be available later this year.

(5) The Senate Bill seeks to promote and maintain a superior aviation industry and in so doing it seeks to determine whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are nondiscriminatory and at least in conformance and parity with non-aviation standards, practices and regulations (including de facto circumstances) as it concerns: "measures, procedures and capabilities for extinguishing fires and the removal of smoke and toxic fumes within safe pressurization limits."

Removal of smoke and toxic fumes is directly related to the quantity of outdoor air which is ventilated through the aircraft per unit time, i.e. number of fresh air changes per hour. There are Federal Aviation Regulation requirements to accomplish smoke evacuation for the cockpit. There are none whatsoever for the passenger cabin. The hearing record clearly substantiates this fact. Current regulations and practices are discriminatory in the face of known and recognized hazards.

As it concerns "capability for extinguishing fires" we believe the record speaks for itself. The "SAFER" Committee, NTSB and FAA have recommended improvements in the area. It would be interesting to know what the FAA actually has done in this area especially as it concerns the expert recommendations for immediate action provided to the FAA by the SAFER Committee two years ago.

(6)(a) The Senate Bill seeks to promote and maintain a superior aviation industry and in so doing it seeks to determine whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are nondiscriminatory and at least in conformance and parity with non-aviation standards, practices and regulations (including de facto circumstances) as it concerns: "safe pressurization, considering the broad range of cardiopulmonary health of the traveling public; dissemination of information to the medical profession and the general public of current pressurization limits and practices to assure valid medical advice concerning the health effects of air travel."

In the absence of any effective regulations to assure proper and reasonable pressurization for the general public, it appears obvious that appropriate corrective action should be taken at the earliest possible date.

See FAA Docket No. 20351. This document shows that approximately seven people out of every hundred air travelers with recent heart trauma or acute ischemic heart disease, die within three to four days of air travel. The American Medical Association has recently alerted their members concerning this. The need for studies is clearly substantiated, as is the need for immediate corrective action.

(6)(b) The Senate Bill seeks to promote and maintain a superior aviation industry and in so doing it seeks to determine whether industry practices and standards, Federal Aviation Administration rules, regulations and minimum standards are nondiscriminatory and at least in conformance and parity with non-aviation standards, practices and regulations (including de facto circumstances) as it concerns: "collection and dissemination by the aviation industry, the FAA, and/or any other private or governmental organization of a data base of medical statistics relating to air travel, in an effort to assess the adequacy of aircraft systems, design, regulations, standards and practices from a health and safety standpoint and for the purpose of issuing FAA administrative advisory circulars and airworthiness directives to correct any deficiencies disclosed."

Our answers to questions that you have posed, along with the answers and testimony provided by others at the hearing and later, plus the available information in FAA Docket No. 20351, clearly demonstrates the need for studies. All the Exhibits we have submitted so far support this position.

EXHIBIT A (1 page).—Letter from G. F. Hohn, Manager of Standards, ASHRAE, June 18, 1982.

Summary: This document proves that contrary to statements made by the FAA there are no ASHRAE Standards for fresh air ventilation on board aircraft.

EXHIBIT B (2 pages).—Letter from Xenex to Administrator, FAA, 22 December 1980. 2. Letter in response to (1.) from Jerry Chavkin, Chief Aircraft Engineering Div., Office of Airworthiness, FAA dated January 12, 1981.

Summary: These documents demonstrate that FAA assured Xenex Corporation they would address the serious issues of smoke and toxic fumes on board aircraft during emergency conditions in conjunction with their response to the Xenex petition for rulemaking, FAA Docket No. 20351.

EXHIBIT C (272 pages).—1. Aircraft Fire Smoke and Fume Occurrences. 2. Guide for interpreting data in (1.). 3. Various information concerning aircraft utilization in U.S.

Summary: These 234 pgs.! (Exhibit C1) which cover a recent five year period (1977-1982) entail 3,022 occurrences of fire, smoke and fumes on board U.S. aircraft (also includes explosions). We have included, for publication purposes, an extra set of the first ten pages of the Accident/Incident report. The balance of the Accident/Incident and Service Difficulty reports are available from the Committee or Xenex Corporation. Testimony at the May 20, 1982 hearing indicates that approximately 90% of all aircraft fires occur in flight! What was not apparent at the hearing, but which is revealed in this exhibit is the magnitude of the fire, smoke and fume problem occurring on board aircraft. What is further apparent from these 3,022 reports of aircraft fire, smoke and fume occurrences in a serious problem of classification of the occurrence. The report (Exhibit C1) reveals that although, emergencies arise and aircraft are filled with smoke in the passenger cabin or the cockpit and forced to make unscheduled landings due to these problems, the FAA has classified many of these serious safety problems as maintenance problems!

EXHIBIT D (4 pages).—Outdoor Air Requirements Standards and Practices, Comparison Between Various Aviation and Non-Aviation Environments.

Summary: These documents demonstrate conclusively that current fresh air ventilation practices on board passenger carrying aircraft are only a small fraction of the minimum requirements and standards in the non-aviation environment. Assuming a 50% occupancy rate in the passenger cabin of an aircraft, the fresh air ventilation rates are approximately 1/15th to 1/30th of that of the cockpit. At full occupancy of the passenger cabin, the fresh air ventilation standards are obviously worse. Also shown in this exhibit are the incorrect standards as stated by the FAA at the May 20, 1982 Senate hearing.

EXHIBIT E)42 pages).—1. Letter from Dr. A. J. Clayton, Laboratory Centre for Disease Control, Ottawa, Canada, dated July 5, 1982. 2. Letter from Xenex Corp. to Dr. A. J. Clayton dated 21 July, 1982. 3. Enclosure from Dr. Clayton's letter—The Transmission of Exotic Virus Diseases Through Air Travel. 4. Study of the Microbiological Environment Within Long- and Medium-Range Canadian Forces Aircraft. 5. Containment Aircraft Transit Isolator, Aviation, Space, and Environmental Medicine, October 1979 along with brochure concerning isolator.

Summary: Dr. A. J. Clayton, MD, ChB, DPH, FFCM, FRCP(C), Director General, Laboratory Centre for Disease Control, Ottawa, Canada, has studied disease transmission on board aircraft (Exhibit E3, E4, E5). He concludes that there is "a significant risk to other passengers of acquiring a highly transmissible disease, such as Lassa fever, Marburg, Ebola virus disease, or Smallpox." His studies also address other transmissible diseases such as influenza, Chickenpox, and other airborne transmitted diseases. Dr. Clayton also points out that if airlines are now supplying air at a rate of 5 cubic feet per minute per person, then clearly the risk of direct airborne transmission is higher than demonstrated in his previous study. He concludes: ". . . I would support from an epidemiological and microbiological point of view, your contention that there is a risk for transmission of disease in passenger aircraft, particularly when ventilation rates are at level of 4 to 7 cubic feet per minute." (per person).

EXHIBIT F (20 pages).—ASHRAE Standard 62-1981 Ventilation for Acceptable Indoor Air Quality.

Summary: These documents clearly demonstrate that the minimum outdoor air requirements when smoking is permitted, is 50 cubic feet per person per minute for bars and cocktail lounges, 35 cubic feet per person per minute for dining rooms, cafeterias, and fast food facilities. Numerous other minimum outdoor air requirements for various facilities are also noted.

EXHIBIT G (34 pages).—1. FAA Docket No. 20351, Petition for Rulemaking Letter from Xenes to Administrator, FAA dated September 30, 1980 concerning rebuttal comments to AIA.

Summary: These documents entail a dispute within industry as to the merit of implementing rules, regulations and standards pertinent to the issues of Senate Bill S. 1770. Among other things, the documents prove that the occupancy density on board aircraft is in excess of 200 persons per 1,000 sq. feet of floor area (twice the maximum anticipated in a comparable non-aviation environment); that current ventilation practices are, in fact, approximately 5 cubic feet per person per minute of fresh air; that cabin ventilation pressurization is accomplished in large measure by means of uncontrolled leakage rather than controlled leakage as it should be; that humidification on board aircraft is, in many cases, almost exclusively from the unsterilized sweat and breath of occupants on board and many other pertinent facts.

In addition, it is pointed out to the FAA that current law concerning ventilation requirements is misquoted in a misleading manner, (implying that there are some form of standards, when in fact there are none). It is most interesting to note that not only was this misquote of the law echoed by the Aministrator in his subsequent denial of the petition, in spite of being advised by Xenex Corporation, the statement of the law was false. Moreover, and quite shockingly, the FAA proceeds, again in spite of the advice to the contrary, to misquote the law, most recently in an apparent effort to mislead the Senators on the Aviation Subcommittee. One misquote of the law might be excused by some people(?) as a typographical error. However, two additional ones, (not by the AIA, but the FAA!) one to the citizens of this country, the other one to the United Sttes Senate Aviation Subcommittee, after having been advised of erroneous statement, is no longer possible to ascribe to typographical errors. It is an apparent, wilfull attempt of misrepresentations, affecting millions of people.

EXHIBIT H (33 pages).—1. The Effect of Indoor Relative Humidity on Absenteeism and Colds in Schools, George H. Green, ASHRAE Journal January 1975. 2. The Effect of Indoor Relative Humidity on Colds, George H. Green.

Summary: This document discloses that a correlation exists between indoor relative humidity and absenteeism due to "colds"; that an increase in relative humidity from 22 percent to 35 percent shows a reduction of 20 percent in absenteeism due to colds. It is further disclosed that a 20 percent in absenteeism in the United States could amount to savings on the order of one billion dollars per year. The data in these exhibits have also been presented to the American Association for the Advancement of Science.

EXHIBIT I (13 pages).—Letter from Xenex Corp. to the Administrator of FAA dated November 7, 1980 re rebuttal response to ATA comments concerning FAA Docket 20351.

Summary: This document, like Exhibit G, discloses a dispute in industry concerning appropriate rules, regulations and standards concerning the issues of Senate Bill S. 1770. The document discloses disputes of cost in revenue losses due to payload displacement versus the benefits of improved ventilation and humidification standards. Also discussed is "ventilation poisoning", an affliction preceding suffocation. Solutions to "the tobacco smoke issue" are also discussed.

EXHIBIT J (1 page).—Letter from Leslie Q. Tam, PhD., to Xenex Corp. dated 23 July 1982.

Summary: This document from Leslie Q. Tam, PhD., University of Hawaii, discloses that the highest bacterial counts for various aviation and non-aviation facilities were found on board aircraft—256 colonies, and the lowest bacterial colony counts were found in libraries—2 colonies.

EXHIBIT K (20 pages).—Tobacco smoke, Ventilation, and Indoor Air Quality by J. L. Repace, Environmental Protection Agency and Alfred H. Lowrey, research chemist, Naval Research Laboratory, both of Washington, D.C.

Summary: This document discusses the effects of "passive smoking". Exposure, risks, mortality rates etc. are disscussed. The factors determining indoor concentrations of tobacco smoke are also explored.

EXHIBIT L (10 pages).—The Problems of Passive smoking by James L. Repace, Office of Policy Analysis, U.S. Environmental Protection Agency, Washington, D.C.

Summary: This document reiterates and amplifies the material in Exhibit K. Of particular importance is the apparent fact some employees have resorted to litigation and thereby established their right to a smoke free environment, among them an airline stewardess has successfully collected workman's compensation for injuries suffered due to improperly ventilated work environment.

EXHIBIT M (55 pages).—Transcript from Fifth Human Factors Workshop on Aviation.

Summary: This document contains selected materials from a transcript of a conference/workshop on aviation conducted July 7–8, 1981 under the sponsorship of the FAA. Among other things, is discussed the inadequacy or uselessness of the current oxygen equipment on board aircraft, for use by passengers as smoke protection. Also described are new systems which can provide toxic fume protection for passengers and crew on board the aircraft. Numerous matters concerning human factors, problems and solutions are discussed. It is also stated that "within approximately 60 days" (from July 8, 1981) the FAA expects "to put a program together" in response to the findings made in the course of the conference/workshop. As of today, we are not aware of any such program even though more than a year has passed.

EXHIBIT N (5 pages).—1. Statement from Docket Clerk on Docket Sheet FAA 20351. 2. Letter from Charles E. Weithoner, Associate Administrator for Administration, FAA, dated June 18, 1981 to Xenex Corp. 3. Letter from Anthony J. Broderick, Technical Advisor to the Associate Administrator for Aviation Standards dated March 31, 1981, enclosed docket sheet with notation.

Summary: These documents prove that several documents submitted by Xenex Corp. were received by the FAA prior to the closing deadline for comments on the petition for rulemaking, Docket 20351, according to a signed statement by the Docket Clerk (petitioner hand delivered several of his own comments and those of J. Repace dated 8/19/80). However, none of these comments were considered by the Administrator when rendering his decision of denial of the petition. The Administrator's statement in the denial indicates that these documents were not received before the closing deadline, which is false. In addition, the carefully worded letters from the FAA appear to be an effort to make the reader believe that these and other comments were considered by the Administrator, when in fact by the Administrator's own statement (in the denial of the petition) they were not.

EXHIBIT O (18 pages).—Excerpts from Federal Aviation Regulations, Par. 121.220 Cabin ozone concentration; 121.219 Ventilation; 25.831 Ventilation; 25841 Pressurization; 25.851 Fire Protection, Fire Extinguishers plus peripheral paragraphs.

EXHIBIT P (2 pages).—Comments by James L. Repace to Petition for Rulemaking, Docket No. 20351 concerning carbon dioxide, carbon monoxide levels.

Summary: This document which is in response to the petition for rulemaking to improve cabin air quality standards discloses the inadequacies of current ventilation practices and maximum contamination rules for carbon monoxide and carbon dioxide on board aircraft. The document states that maximum carbon monoxide contamination levels on board aircraft are five times higher than the maximum allowed under Environmental Protection Agency standards for the general population. It also demonstrates that the maximum contamination levels of carbon dioxide for aircraft is twelve times higher than the ASHRAE Standard, which applies to the general population.

EXHIBIT Q (2 pages).—"Physician's letter"

Summary: The original Exhibit, in the form of a 6 page letter from a physican specializing in allergy, clinical immunology and pulmonary medicine, has been replaced by a synopsis submitted by the writer in order to maintain anonymity of all parties concerned, especially the doctor's patients, a large number who are airline personnel. Medical afflictions relating to the environment on board aircraft are ex-

posed as well as studies that indicate that of more than 200 flights survyed 64% were reported to have "unsatisfactory" air quality on board. The document also states that there exists an industry-wide problem which no longer can be covered up and that there are enormous pressures to prevent airline employees from disclosing this information to the public.

EXHIBIT R (27 pages).—Selected portions from publication entitled "Human Factors in Air Transportation" by Ross A. McFarland, PhD., Harvard School of Public Health, First Edition 1953.

Summary: Indoctrination and training of flight crews, sanitation and health and airline operations, care and contentment of passengers and incidents of passenger discomfort in airline operation. A paper by Ross A. McFarland, published in the American Scientist, Vol. 63, is also included along with an ASHRAE document relating to the thermo comfort of seated persons relating to temperature and humidity. Proposed ASHRAE Standards depicting relative humidities of maximum 60% and minimum 20% are also noted. An index of intensity of body odor is also disclosed. This index demonstrates that at least 40 cu.feet of odor free air per person is required to maintain the body odor intensity at a "moderate" level for a per person air space of just under 50 cubic feet. Unfortunately, the index does not approach the current high densities which only provide for a 30 to 35 cubic feet of air space per person. Nevertheless it can be readily surmised that a greater quantity than 40 cfmp of fresh or "odor free" air is required for the 30 to 35 cubic feet of air space.

EXHIBIT S (1 page).—Excerpt from publication "Airborne Infection: Transmission and Control" by Riley and O'Grady, Macmillan Co. 1961, concerning control of disease transmission as a function of air change per unit time.

Summary: This document discloses that the environmental control of infections transmited by droplet nuclei can be achieved by increasing ventilation. Epidemiological evidence indicates that at least one air change per minute for an equivalent reduction in airborne organisms is needed.

EXHIBIT T (3 pages).—Selected Articles from OAG Frequent Traveler Magazine October 1981, July 1982, August 1982.

Summary: These documents disclose that airlines have reduced fresh air ventilation on board aircraft and in some cases, removed some of the ventilation equipment altogether. It is clear from the articles in these documents that the editorial opinions of "Frequent Flyer" magazine are opposed to the practice of reduced fresh air ventilation. It is also noteworthy to consider that the readership of this magazine numbers approximately one-quarter million people, most of whom are frequent flyers.

EXHIBIT U (1 page).—Page from Operations Manual for 737 aircraft.

Summary: This document discloses that pilots will not deploy passenger oxygen masks when excessive smoke is in the passenger cabin because those masks are useless for the purposes of toxic fume protection.

EXHIBIT V (46 pages).—Cabin Safety: "SAFER Committee" Update Hearings before the Subcommittee on Oversight and Review of the Committee on Public Works and Transportation, House of Representatives, 96th Congress.

Summary: This document is an excerpt of selected pages. Numerous safety issues are discussed from seat strength to smoke and toxic fume issues. A noteworthy statement by the SAFER Committee is that it recommended (in 1980) "IMMEDIATE ACTION" concerning re-evaluation of toxic fume protection for passengers (and crew members) on board aricraft. This recommendation was submitted to the FAA! (The SAFER Committee was comprised of 150 of the world's leading experts in aviation systems and safety.)

EXHIBIT W (105 pages).—1. Communication from Flight Safety Foundation 13 May 1981 and List of Flight Safety Foundation Membership. 2. Aircrew and Passenger Protective Breathing Equipment Studies. D. DeSteiguer, et al. 3. A Protective Passenger Smoke Hood, April 1967 Office of Aviation Medicine, Federal Aviation Administration, Ernest B. McFaddens, M.S. et al. 4. Aircraft Accident Report concerning PAA, Boeing 707-321C, November 3, 1973, NTSB.

Summary: These documents disclose that the Flight Safety Foundation has knowledge of the need for toxic fume protection on board aircraft; numerous studies by the FAA concerning flight crew smoke goggles (cockpit crew); several systems for protection against toxic fumes are also discussed (passenger use). (Subsequently these devices have proven to be impractical or inadequate as opposed to the current state of the art where there are practical and useful devices being developed for pas-

senger use and protection.) Also discussed, an aircraft accident in Boston, where smoke and noxious fumes were determined to be the causative factors of the accident.

EXHIBIT X (74 pages).—Presentation by Xenex Corp., SAFE Association and Society of Automotive Engineers, A-10 Aircraft Oxygen Equipment Committee, December 1981.

Summary: This document discusses the issues of smoke and toxic fume protection for airline passengers and cabin crews. The documentation conclusively demonstrates (a) there is no protection for passengers, either in the form of protective breathing equipment, nor (b) adequate smoke evacuation means; exhibits disclosing recent accident information reveals that numerous people have been asphyxiated due to smoke and toxic fumes on board aircraft, even though the aircraft have landed safely within a few minutes of discovering such emergencies. Also disclosed is a concern over "lethal luggage"; an FAA/industry meeting concerning passenger smoke protection devices; a study of patients with recent history of heart attacks; numerous other matters relevant to the issues of Senate Bill S. 1770.

EXHIBIT Y (15 pages).—Viruses and Indoor Air Pollution by Robert B. Couch, M.D., Dept. of Microbiology and Immunology, Baylor College of Medicine, Vol. 57, No. 10, December 1981.

Summary: This document discusses viruses and pollution and the spread of airborne diseases. It is disclosed that the degree of ventilation, the density of people and the temperature and relative humidity are factors that influence the spread of bacterial and viral diseases.

EXHIBIT Z (48 pages).—1. Human Response to 78-Hour Exposure to Dry Air Arch. Environ. Health, Vol. 29, December 1974. 2. AFA Air Flow Aboard Aircraft, also Reports of Ventilation Complaints. 3. Air Conditioning and Pressurization System B727. 4. DC-10 Air Conditioning and Pressurization. 5. Oxygen in General Aviation, September 1966 Stanley R. Mohler, M.D., Federal Aviation Agency, Office of Aviation Medicine. 6. Letter from Rolf Dangers, Pres., National Draeger, Inc. dated July 23, 1982 to Xenex Corp. 7. Letter from John N. Deutschlander, Marketing Manager, Sierra Monitor Corp. dated July 22, 1982 to Xenex Corp. and enclosures. 8. Sketches describing toxic fume protective breathing equipment for airline passengers and crew—Xenex Corp. 9. Letters dated December 21, 1981 and February 12, 1982 from Don deSteiguer, Chief, Evacuation Research Unit, Protection & Survival Laboratory, Civil Aeromedical Institute with text results of Xenex Corp. toxic fume protective breathing equipment; letter from Xenex Corp. to Mr. Don deSteiguer dated January 6, 1982.

Summary: These documents disclose that a study entitled "Human Response to 78-Hour Exposure To Dry Air" which has frequently been quoted as applicable to the current environment on board aircraft is, in fact, not applicable at all by virtue of the statements made by the researchers conducting the study. Also disclosed are various contamination monitoring equipment and the fact that it has been discovered that the contamination rate on board some aircraft may be as high as 10%. It is further mentioned that at these contamination levels the environment can be lethal and potentially explosive. Favorable test results obtained by the Civil Aeromedical Institute for toxic fume protective breathing equipment are also disclosed.

ASSOCIATION OF PROFESSIONAL FLIGHT ATTENDANTS,
Euless, Tex., May 1, 1982.

Hon. DANIEL INOUYE,
U.S. Senate, Washington, D.C.

DEAR SIR: Your interest in passenger and flight crew health and safety is followed with care by specialists of our Association. As you know, neither OSHA nor the FAA has clear jurisdiction in these areas so very important to us. The average seniority in our Flight Attendant corps is in excess of 10 years and the cumulative effects, especially in terms of aircraft pressurization and air quality on the general state of health of our members, are of great concern to us.

Additionally, the area of noise pollution on board commercial aircraft is of great concern to us. An informal study conducted by us revealed that Flight Attendants are routinely exposed to noise levels far in excess of OSHA standards, resulting in substantial hearing loss. This affects Flight Attendants, pilots, as well as passengers. You have our full support, and we would be very pleased to provide you with our documentation.

Very truly yours,

BRUNO PALUK, *President.*

SERVICE EMPLOYEES INTERNATIONAL UNION, AFL–CIO/CLC,
Washington, D.C., June 25, 1982.

Hon. DANIEL INOUYE,
U.S. Senate, Washington, D.C.

DEAR SENATOR INOUYE: I was so pleased to see that you have introduced S. 1770. I do a great deal of airplane traveling and noticed how difficult it becomes to breathe, especially in cross country flights.

I hope that you push your legislation to provide for a study, because I am sure that you will find that a great many people are experiencing a slight sense of suffocation as they travel in airplanes these days.

Sincerely yours,

RICHARD E. MURPHY, *Director.*

SIERRA MONITOR CORP.,
Sunnyvale, Calif., July 8, 1982.

Senator DANIEL INOUYE,
Russell Senate Office Building,
Washington, D.C.

DEAR SENATOR INOUYE: As a frequent airline passenger, I read with interest about the subject bill introduced by you and Representative Heftel, which would require the FAA to conduct a six-month study to see whether airline passengers are getting enough air to breathe.

Having survived more than one stifling cabin prior to take-off, I can identify with the problem, and suggest that the issue is more one of personal safety than it is of personal comfort.

On my way to the American Industrial Hygiene Conference in Cincinnati a few weeks ago, I had the rare opportunity to test both cabin oxygen level and cabin pressurization altitude with a new Oxygen Deficiency Monitor manufactured by Sierra Monitor Corp. The unit is about the size of a cassette recorder, so it was easy to bring it aboard in my briefcase.

On four separate flights, I noted the change in percent oxygen in the cabin from boarding until approximately 15–20 minutes into the flight. I took readings at about one minute intervals while we were boarding and awaiting take-off clearance, noting both percent oxygen and atmospheric pressure (in mm of mercury) by reading directly off the display of my monitor.

I was surprised to find that not only did percent oxygen fall sufficiently from normal (20.9 percent) to trigger an audible 19.5 percent alarm on the monitor, but in a couple of cases it dropped to 19 percent. Every flight had a full passenger load. The longer we stayed on the ground, the greater the oxygen deficiency. Any air which entered the cabin likely contained a high concentration of hydrocarbons and products of hydrocarbon combustion, especially when our plane was following the exhaust of another to the take-off point.

The OSHA 19.5 percent safety limit may not apply to passengers, but it must certainly apply to personnel in the workplace, namely flight attendants and pilots. If the difference between 20.9 percent Oxygen and 19.5 percent Oxygen appears at first insignificant, consider that it takes a 7 percent air contamination to reduce the oxygen concentration by that small percentage. Tc emphasize my point, 7 percent of carbon monoxide in air is lethal; 7 percent methane in air is flammable and explosive.

Needless to say, the airlines require some education on oxygen deficiency and confined spaces, and I shall approach my next flight with more concern than before. It seems reasonable to assume that passengers with respiratory or circulatory problems are likely to be put at more discomfort and risk than I was.

Good luck on the passage of your bill.
Sincerely yours,

JOHN N. DEUTSCHLANDER,
Marketing Manager.

J. W. BAUDER ASSOCIATES, INC.,
Dallas, Tex., July 26, 1982.

Hon. DANIEL INOUYE,
U.S. Senate, Washington, D.C.

DEAR SEN. INOUYE: As a frequent flyer, I can attest to the poor quality of air on modern aircraft. I totally support your efforts to investigate this problem, and in particular urge you to pass legislation outlawing smoking on commerical flights.
Sincerely,

GUY W. SIMPLER.

ARDE, INC.,
Mahwah. N.J., August 12, 1982.

AMERICAN AIRLINES,
Post Office Box 61616, DFW Airport, Tex.,

DEAR MR. HANNAN: I would like to take this opportunity to thank you and Mr. Masiello for taking the time to review my recent correspondence pertaining to in-flight air conditioning.

I have a number of American Airlines flights scheduled in the next few months and I will keep records regarding flight air quality and circulation and plan on obtaining from the flight crews specific comments.

The attached article is just the tip of the iceberg. I want you to know that the traveling public is *really* upset about this problem and if the airline industry and the Reagan adminstration does not understand that, they are making a grave mistake.

Again, thank you for your time and I hope the scheduled DC-10 ventilation modification will correct some of these problems.
Very truly yours,

THOMAS F. CALLAHAN,
Vice President, Marketing.

Enclosure.

SET THE AIRLINES FREE TO ASPHYXIATE

Those two congressional bills that would require FAA to study fresh-air requirements for airline passengers [INTELLIGENCER, July] are being opposed by two powerful lobbies: the airline industry and the Reagan administration. Both have told a Senate committee that the quality of air on board commercial jets is adequate, and that no questions need to be asked. Meanwhile, Sen. Barry Goldwater (R-AZ) has joined the move to demand a study that would examine air quality, circulation, humidity levels and air contamination in flight. Goldwater also wants some questions answered about the lack of medical-emergency equipment on aircraft. Sen. Daniel Inouye (D-HI), sponsor of the Senate bill, has hinted that he may change the wording of the proposed law to assign the study to the Federal Trade Commission rather than to the FAA. Of the two, FTC is widely regarded as more hard-nosed on consumer issues.

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